How to Make Jewelry

SECOND EDITION

By GEORGE S. OVERTON

PRACTICAL INSTRUCTIONS FROM A PRACTICAL MANUFACTURING JEWELER

With Eight Chapters on

How to Make Plated Jewelry

By ALVAN H. WHITING

Being Articles Reprinted from
"THE MANUFACTURING JEWELER"

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Cordially Yours
Geo. S. Overton

TABLE OF CONTENTS.

How to Make Jewelry.

How to Make Jewelry—*Continued.*

PART TWO.

Making Plated Jewelry.

PREFACE TO FIRST EDITION.

IN publishing a weekly trade paper, a host of material comes to the editor's desk, and his success as the director of the publication lies chiefly in winnowing the wheat from the chaff. The great task of an editor of a jewelry trade paper is to secure accurate technical articles which do not show on their face the traces of being copied from old and perhaps obsolete works. In the course of a long apprenticeship at the editor's desk in the office of THE MANUFACTURING JEWELER, I have learned that the men who have the technical knowledge either will not impart it to the world, or else they lack the proper powers of expression. This is the general rule, but once in a while there is an exception. The present volume is a case in point.

When the first few of these articles were offered to THE MANUFACTURING JEWELER for weekly publication, I did not realize their true value, and did not expect the series to be prolonged. Gradually, however, I saw that a master of jewelry technique was divulging information of incalculable value, both to the beginner and to the experienced jeweler. My own views were soon reinforced by emphatic protests against continuing the articles from one of the largest manufacturers of gold jewelry, on the plea that Mr. Overton was giving away trade secrets. Threats of legal action were also made.

Mr. Overton's experience has been chiefly as foreman and superintendent of gold shops, and therefore this book deals largely with the making of jewelry from the precious metals. As the book developed, however, sup-

plementary instructions relative to making work in rolled plate were inserted. Real jewelry is, of course, made of the precious metals, and if one is fully competent to make such jewelry, the knowledge of how to make goods in brass or rolled plate can be acquired very easily.

In preparing Mr. Overton's articles for publication in book form, they have been carefully edited, rearranged in suitable order, and one entirely new chapter added. An elaborate cross index has been made and inserted in the closing pages of the book.

We have had many requests for the articles in permanent form, and believe that this book will soon come to be regarded as a standard. There is no other work, either in England or America, which deals with the subject of jewelry-making in so complete, detailed and informing a manner.

WALTER B. FROST.

Providence, R. I., 1914.

PUBLISHERS' PREFACE TO SECOND EDITION.

THE regular and continuous demand for the first edition of Mr. Overton's book — a demand from all lands and all quarters of this country, exhausted the supply, which was originally much larger than we had good reason to believe would be required.

As the book was written more particularly for the worker in gold and platinum, it did not fully meet the needs of the commercial manufacturer, in large quantities, of plated or brass jewelry. Realizing that a second edition would be demanded, we looked about to find a man of wide experience who thoroughly knew how to establish and run a shop for making plated jewelry, and furthermore was able and willing to place that knowledge before his fellow-men.

We were fortunate in securing Mr. Alvan H. Whiting, an experienced manager of jewelry shops, who has contributed eight chapters on "HOW TO MAKE PLATED JEWELRY," which covers the ground in a remarkably clear and comprehensive manner, and is written in a sprightly and readable style. These chapters are grouped under Part II towards the end of the volume.

The addition of this important information for the young or inexperienced manufacturer well supplements Mr. Overton's invaluable work, which has become a standard in its class, and is used as a text book by many schools and by the vocational department of the United States Government.

WALTER B. FROST.

Providence, R. I., 1920.

AUTHOR'S PREFACE TO SECOND EDITION.

IN reviewing the pages of "How to Make Jewelry," for a second edition the author is impressed with the fact that during the past ten years some rapid strides have been made in jewelry-making. By reason of the demand for platinum by the Government during the war, — also the enormous increase in its cost, the jewelers have experimented with combinations of other metals as substitutes. Hence, "White Gold" and "Green Gold" in various qualities have been put on the market with considerable success. These new alloys, with a number of new shop "kinks," are given in this Second Edition.

The author wishes to tender his most sincere appreciation to The Manufacturing Jeweler, which has, more or less precariously, undertaken to give in book form his articles, originally contributed weekly, for the benefit of the young, ambitious jeweler, and also to thank those who have so kindly expressed their approval.

GEORGE S. OVERTON.

Newark, N. J., July 1920.

HOW TO MAKE JEWELRY

PART I.

CHAPTER I.

DESIGNING.

New Designs Needed Every Day—A Large Demand for Competent Designers—Material Necessary for Work—How to Make Tracings—Colors that Go with Different Stones—How to Get Ideas for New Designs.

THE manufacture of jewelry has now reached a stage where new and original ideas in novelties are being constantly demanded and expected. New adaptations of conventional designs, flowers, horseshoes, in combination with some fancy ornament, etc., will, if strikingly original, always find a market. As a consequence there is a large field for designers, and within the last fifteen years a host of young men and women, learning of the large salaries paid to some designers, have acquired a little "taste" and the rudiments of drawing, and, armed with a few samples of their "art," are boldly seeking positions as designers of jewelry, usually expecting unreasonable salaries. And like the graduate from a three months' course at the business college—"there is nothing to it."

The best designers, in nearly every instance, are those recruited from the ranks, who have served their time as jewelers, and who have a natural bent for sketching. The apprenticeship at the bench has taught them the practical side, at the same time familiarizing them with detail, knowledge of construction, etc., so they may later be in a position to explain, or to superintend, the carrying out of their own ideas. The writer has been in contact with, and has employed, designers who could draw and paint beautifully, and who could successfully carry out ideas furnished them. On the other hand, commis-

sion them to make an original design, limited to so many stones, etc., and to be a certain size, and they were lost, having no practical knowledge of thickness, setting or construction. It is safe to assume that these same young people would not seek jobs as designers of elevators, dynamos, or battleships, and yet they are as well fitted for these vocations. An attractive design can be sometimes altered and made practical by the workman; this, however, is a poor haphazard business, as you never know just what you are going to get. In this connection I am reminded of a story told by an old-time but well-known manufacturer of fine jewelry. The customer was describing to the salesman in the store a brooch she had in mind and wished to have made. Glancing into the showcase she pointed to a brooch and said, "Something like that," and mentioned a few changes. Later, the wholesale man called, and the salesman gave him the order, describing what the customer wanted, as he remembered it. The wholesale man returned to the office, handed along the order to the office order man, who sent it to the factory superintendent; he selected a workman, and giving him the instructions with his interpretation of same, the pin in the natural course of events was finished and sent to the store. When the lady was shown the pin she exclaimed, "I ordered a brooch, not a jew's-harp!"

Have a sketch exactly as you want the finished article to be furnished the workman, and he will have no excuse to offer.

Make practical designs. A brooch should be drawn with plenty of strength and enough surface to hide the joint and catch. A pendant can be much more delicately drawn. Always make the sketch so that no extra scroll has to be "plastered" on afterwards.

There are very pretty delicate little effects in jewelry in the stores, lots of them impractical. The sale of such is restricted, while the substantial, common-sense article sells over and over again.

There are numbers of boys and men working in jewelry factories who very likely have a latent ability for

designing, and are hesitating because they don't know just how to go at it. To these the writer gives here a few tips, gathered during some twenty-five years of experience in large jewelry factories, several of them as designer and superintendent.

Get a cheap pad and pencil and à catalogue of jewelry designs; start copying them. Always draw a line up and a line across at right angles; this gets a center and helps in the correct spacing, etc. Don't use the rubber too much; start fresh drawing; ideas will suggest themselves as you go along. Take a sunburst, see if you cannot make the scrolls run a little different, or try to draw a little ornamentation in a pearl crescent; attend drawing school; learn to model (although not absolutely necessary); try to be original, and always practical. As you improve, get different hardnesses of pencils. Hardtmuth pencils up to 6 H. are excellent; also Fabers; use a red (ruby) rubber, kept clean; the design should always be clean, not smudgy. When you get a pin or something drawn that looks pretty good on your pad, go over it with a pen and ink; let it dry, and rub all pencil marks off, leaving the ink tracing standing out clean. Now get some tracing paper at the stationer's, about a yard for twenty-five cents, enough to last a year; cut into convenient sizes and keep in an old book; take a piece and after lining up and across, carefully trace your design; if quite tedious, the tracing paper is fastened to pad with a little drop of mucilage at each corner. Watch for any imperfections in spacing or where a scroll could be more rounded, etc. Now remove and place on a card your tracing, with the lead pencil side on the card, and carefully go over the reverse side with a harder pencil, and upon removing, the design is found transferred on the card; examine carefully to see that drawing is correct before putting on finishing touches, shading, etc., and coloring.

Get a water color box for about one dollar, with a half-dozen red sable brushes, fine and pointed. We will suppose the pin is gold, rose finished. First, go over the design with a pale wash of gamboge; let it dry, then

shade, using yellow ochre, always remembering that the most prominent scrolls are the most strongly shaded. This throws them up, making them stand out from the background. A little burnt sienna is painted in recesses to give the rose finish effect. Do not be discouraged if you get too much color on. Make another tracing on another card. Stick at it and you will succeed. The very highest points of the scrolls are brought out by a touch of Chinese white, bought in tubes, and rubbed up with a little water. After drying, lightly moisten with a little pale chrome yellow. In colors for stones the Chinese white is background for the diamond or pearl, shading and lining with sepia mixed with the white; cobalt, shaded and lined with indigo blue for sapphires; carmine red mixed with cobalt is an excellent amethyst color; emerald green, shaded with sap green for green stones, and the yellow colors before mentioned for the topaz, etc. All of these stones are made to "stand" out better by the judicious use of the lead pencil to sharpen up the point of division between the light and shade and also to mark off facets. A few specks of the Chinese white is applied on the side of stone not shaded. Bear in mind that all colors are first applied as a faint wash, the shading and faceting applied after to get best results.

Go to the library of your town, look over books of architecture and decorative designs. Some beautiful designs are gotten from looking over patterns in wall paper. Note the carving of the masonry on public buildings. Get books and the latest plates of designs of jewelry from abroad. H. C. Perleberg, jewelry designs, Jersey City, makes a business of getting original plates, photographing them and selling copies to the trade.

Bruno Hessling, 64 East 12th street, New York, deals in books of designs covering the prehistoric period. Egyptian, Indian, Roman, Chinese, and many others, down to the modern ornament of the renaissance, rococo, the colonial style of the United States, etc. Some jewelry houses originate, others are content to be trailers. Good ideas are also gotten by examining fine pieces of

jewelry in the first-class stores. Where convenient, the designer should make the trip to New York occasionally, and inspect the goods on display at the downtown stores and along Fifth avenue. This is not done with the idea of copying, but to furnish ideas and to keep one up to date.

Some of the larger jewelry manufacturing firms employ two and even three designers; one of them is usually kept pretty busy on painted sketches of regular goods. These are often sent in place of the real articles on a "memo" or consignment order, thereby keeping stock intact and ready for quick delivery on a *bona fide* order.

A retail salesman can make himself more valuable by being able to make a sketch, carrying out customers' ideas; in fact, some of the larger stores throughout the country employ regular designers. For all designs for painting a pearl gray colored card is most suitable. White cards may be used for pencil sketches or gold work. These cards can be purchased cut to any size from any paper house.

CHAPTER II.

HINTS ON MELTING.

How to Obtain Clean, Smooth Ingots—Crucibles Must be Warmed—Placing the Ingredients—Use of Sal Ammoniac and Charcoal—Importance of Thorough Mixing—Casting the Ingot—Location of Melting Room—A "Kink" in Wire Coiling—Silver Melting.

IT is just as easy to get a good, clean, smooth ingot of gold or silver as it is a bar that is full of holes, grooves or blisters. The poor "melts" are gotten by indifferent or careless workmen, who figure that the subsequent rolling will smooth out everything. As a matter of fact, where the bar is uneven the thinner spots simply stretch, and after rolling to a certain thickness, your plate is full of seams, or cracks and holes, necessitating a cutting out of these portions for remelting. This, of course, is double work and a useless waste of crucibles and gas, to say nothing of the time. Then again the melter may not have a technical knowledge of the principles of melting and is simply following some formula furnished him, or that he has acquired, or he has drifted into the melting room by force of circumstances. To those manufacturers and melters who have met with varying results, the writer proposes to give some little "kinks."

All crucibles, whether sand or black lead, should be first warmed before putting in the metal for melting. The alloy should be put in first, then the copper, then silver, and lastly the gold. The reasons for this are, first, that the alloy and the copper melt first, and secondly, they are protected by the silver and gold from contact with the gases of the furnace, thus greatly eliminating oxides from being formed. Sal ammoniac and pow-

dered charcoal are the agents used to neutralize the gases that form in the crucible, the charcoal acting as a coating cover and the sal ammoniac to purify the alloy while in a molten state. The official melter of the United States assay office at New York uses powdered sal ammoniac and a very fine powder of charcoal which he obtains from the collections on the beams of his melting room. The powdered sal ammoniac is probably bought fresh often, hence is as good as the lump form. For the average jeweler the lump is better, as the strength remains in longer, a little piece being broken off and pulverized as needed. For charcoal the powdered willow, purchased from leading drug stores, is as good as any. Berge, of New York (the crucible manufacturer), handles a charcoal powder which is very good, but under a good stiff flame blows out of the furnace to a great extent and is wasted. It is also a trifle more expensive than the willow charcoal.

The sal ammoniac should be mixed with the charcoal in about equal proportions and enough should be put on top of the gold to cover well before placing in the furnace. Have flame just show through the cover, starting rather scant and increasing the force just as metal is melting. Add a little more of the sal ammoniac and charcoal. When the gold begins to sink to the bottom of the crucible, showing that the other metals are melted, it should be gently pressed down with an iron rod. Sometimes the gold, especially if it is in plate form, will stick for some time as a sort of roof before finally dropping of its own accord into the molten mass in the crucible. As soon as it is melted, which is ascertained by inserting an iron rod or poker, the mass is well stirred.

If a crucible cover, in addition to the furnace cover, is not used, it is well to add a little more of the sal ammoniac and charcoal, stirring just before pouring.

Right here the writer wishes to emphasize the necessity of thoroughly mixing the melts. The old-time melters swear by the rolling down of the stock and cutting up of same and remelting to get a perfect alloy. This

method undoubtedly helps, but is slow, involving as it does a double melting. Stir the liquid mass well, two or three times, or even more, keeping it well covered with charcoal. First stir to the right, then rapidly to the left, and then pour rapidly into your plate or wire ingot. In case of 18-karat gold do not pour too hot; let the crucible commence to show a dull, almost blackish-red before pouring. The 14-karat alloys and lower should be poured as quickly as possible to prevent the base metals from oxidizing by contact with the air. Just before pouring some melters blow in a pinch of saltpetre, placed in the end of a long brass tube. This clears up the surface of the molten metal and perhaps helps a little in getting a cleaner ingot.

Within the last four or five years, and since the first edition was printed, there have come into use a number of green gold alloys in 14-karat and 10-karat, and as the principal alloy used is silver, the melt must be held as in pouring the 18-karat.

The ingot should be well warmed and just moistened with oil to prevent the gold from sticking. Avoid an excess of oil, as it will cause holes or fissures in your bar. In getting bars for wire the writer recommends the open wire ingot. The bar should be well hammered, with annealings frequently to prevent cracks. In 18-karat do not anneal until you have given the gold two or three very heavy drafts in rolls to close the grain. This applies also to all other *soft* alloys, whether wire or plate. In melting spring gold or hard alloys for snaps, pin tongues, etc., where the base metals added are of nearly the same weight, the ingot bar or plate must first be annealed and allowed to cool off slowly before rolling. Do not hammer any hard alloys, but in rolling force the drafts, do not "baby" the stock. This starts a good grain in the metal.

The farther away or the better protected the melting room is from drafts or windows, the better will be the general results. The adding of saltpetre is very hard on the crucibles and is hardly worth while in the long run.

An old pair of canvas gloves will be found handy in facilitating the handling of the furnace cover, ingots, etc.

In rolling wire it may be interesting to the beginner to know that a close, even coil is obtained for annealing, or for convenience in putting in gold box, by pulling the end of wire back over the top roll. When the wire has all passed through, an even coil of about the diameter of the roll is the result. It is surprising that a number of melters to-day who have been in the business for years have not gotten on to this little "stunt" and are still bending the long strip into a coil by hand, getting an uneven coil and risking burning or melting the projecting strands in the subsequent annealing.

Silver is melted and poured pretty much like 18-karat gold. The points to remember are, that it should not be poured any hotter than is necessary and that it should be well stirred with an iron poker. Borax or boracic acid crystals are used in place of sal ammoniac; keep extra well covered with charcoal, add a little more borax as soon as silver is melted. Poke or shove the borax under the charcoal with a long, narrow pair of tongs. The ingot should be just hot enough to permit of the finger touching it for a moment. In annealing after rolling, do not get too bright a red heat, as this will cause air blisters, condemning many a good bar that until then had been all right.

CHAPTER III.

THE ALLOYING OF GOLD.

Gold above 18-Karat Used Only for Special Order Work—Variegated Gold Work—Alloys for Yellow, Green and Red Gold—High Grade Stock for Enamel Work—Hard and Soft Alloys—Standard 10-Karat Formula—Copper Shot vs. Copper Wire.

GOLD of a quality better than 18-karat is seldom used in the manufacture of jewelry, and then only on special order work. The so-called variegated gold work, wherein is seen, say, a fancy bracelet, ornamented with green, yellow, red or blue (platinum) trimming, is made by cutting out the shapes and sweating them on to a plate of gold.

These little ornaments may be cut out in the foot press or shears, as desired, and are usually cut out of 20 stock, dial screw gauge, and soldered on a back of 40 stock. After soldering, of course using best grade of solder for this work, the plate is put in the drop press and a sharp blow flattens and gives a smooth, blended effect. The piece of stock is now ready to be shaped into any pattern desired. In leaf or flower work, where the petals or leaves are of one color gold, the edges only showing variegation, the stock is made by taking a plate of gold 600 points thick for the backing, and soldering on the green, yellow and red in strips 250 points thick, then rolling down to the desired thickness, 60 points being customary for leaf and small work. In order to break the straight line effect where one color is joined to the other, after rolling, little odd shapes or zigzag pellets of green, red or yellow gold are applied on the seam and soldered, a sharp blow under the drop hammer blending them in flush. Fine wires of platinum, used in "veining" leaves, are also applied in this way.

Years ago blue gold, an alloy of 18 parts gold and 6 of iron, was used in place of the platinum. This is, however, an extremely difficult alloy to avoid getting brittle and is best effected by first dipping fine iron wire in sulphuric acid and water to take off the black oxide or scale, or by drawing it through emery paper until it is bright. The gold is first melted under a good layer of charcoal powder, the iron wire carefully added a little at a time and poked well under the charcoal. The bar must be annealed and carefully hammered after pouring and before putting through the rolls.

Some houses use fine or 24-karat for yellow gold. A 22-karat made of 22 pennyweights fine gold, 1¾ pennyweights silver, and ¼ pennyweight copper, shows up as well and is of course not quite so expensive. Green gold is made of various proportions of gold and silver, 19 pennyweights of gold to 5 of silver giving a very deep, rich green. For most purposes, however, an alloy of 17 pennyweights of fine gold to 7 pennyweights of silver is used. The red gold lasting the longest in lustre and presenting the best finish is made of 22 parts gold to 2 of best shot copper, but all proportions are used and an alloy of 14 parts gold to 10 of copper is frequently employed. The writer does not advise using less than 18-karat red gold or 18 parts gold to 6 of copper, as under some conditions the alloyed metal will turn black.

Houses making 14-karat jewelry use different qualities of stock for the backing. Some figure that a 12-karat back will average up the 22-karat, 18-karat, or 17-karat front, as the case may be, so that if goods were assayed the test would show 14-karat as per stamp. Others, to be on the safe side, use a plump 14-karat backing. Of course, there is the solder (usually about 12-karat) which must be reckoned with. However, as the varicolored front is seldom or never less than 17-karat for the green and 22-karat for the yellow, a backing of 12½-karats will assay 14-karat in most cases. A large manufacturer of 10-karat goods with green gold (18-karat)

front uses a back stock of 8-karat and finds his scrap to stand the 10-karat test.

An 18-karat alloy much used to-day in fine diamond work, is made of 18 parts gold, 4 parts silver and 2 of copper. This is a very rich yellow. To get a red, simply reverse the figures of the silver and copper. In the making of enamel work, certain jewelers, in order to reduce the danger of chipping or breaking of the enamel, have used high alloys of gold, in some instances even fine or pure gold, figuring that they are in pocket by eliminating the frequent cost of re-enameling. This, in the case of painted work or finely veined and shaded flower work, where probably the labor is mostly in the enameling and painting, is a practical move and is thoroughly commended. On the other hand, there is a tendency sometimes on the part of the manufacturer to make everything of the higher alloy for enamel goods, and here is where he is going to the bad. One concern, employing indifferent help, went behind considerably by indiscriminately using a 15-karat alloy for their enamel goods and stamping it 14-karat. The fact that it was figured as 15-karat simply caused the customer to wonder at the cost of the goods and to look elsewhere when buying.

An alloy of 14-karat for enameling, of 14 parts gold, 7 of silver and 3 of copper, is recommended for all plain work, and is used for painted flower work in some shops as well. For shell or die work, or for work requiring bending or shaping, a 14-karat polished alloy is made of 14 parts gold, 3 parts silver, 2 of copper and 5 of pale Guinea gold. This alloy needs melting only once, and the scrap should be added to a fresh alloy for remelting.

A tough alloy, excellent for knife edge, screw wire, or open work, is 14 parts gold, 4 of silver, and 6 of copper. This should be melted twice to thoroughly mix. A very hard 14-karat alloy, suitable for bracelet snaps, pin tongue stems or stiffening pieces, is, fine gold, 14 parts; silver, 4½ parts; copper and pale Guinea alloy, 2¾ parts each; total, 24. Another used to-day is, 14 parts gold, with 5 parts each of silver and copper. A fine 14-karat

green gold is made of fine gold 14 parts, silver 8¼ parts and copper 1¾ parts or pennyweights, total, 24. There are also formulas furnished by refiners who sell a special green gold alloy.

There are a number of white gold alloys on the market ranging from 20-karat down. In the better karat qualities palladium was used, but this made an expensive alloy, so that after some experimenting an 18-karat white gold was made out of 18 parts fine gold, 4 parts pure nickel and 2 parts fine iron wire. This is a rich blue-white alloy closely resembling platinum, but is a little hard. Baker & Co., of Newark, N. J., are now supplying a white alloy which works up very well for all karat qualities and is ductile. The basis of all white gold alloys is simply a fine grade of german silver with a high percentage of nickel. In melting white gold alloys the gold is put in last and covered with boracic acid crystals. More heat must be applied than in ordinary gold alloys. When melted, stir well with carbon stick and pour at once, roll as soon as cooled to about two-thirds of the thickness, then anneal, and proceed as in regular alloys. The gold may be plunged while warm (not red hot) in sulphuric acid pickle to remove the black.

In using alloys furnished by the refiners and supply houses no other metal is used, so that 14-karat white gold is simply 14 pennyweights fine gold to 10 pennyweights white gold alloy; 10-karat white gold, 10 parts fine gold and 14 parts white gold alloy, etc.

To get a fine white appearance after a piece of white gold jewelry is made up it must be stripped in the following solution before polishing:

Cyanide copper, 1½ ounces by weight; ammonia, 26%, 4 ounces; carbonate soda, 4 ounces; cyanide potassium, 6 ounces; water, 1 gallon.

Solution may be cold or slightly warm and the cathode a sheet of soft copper, which should, to get best results, entirely surround the jar, although an ordinary carbon will do for small lots. Hang the work, after steel-brushing in bran water, on the positive wire and keep moving.

In a few moments the work will strip bright as silver and may be polished in the usual way. This "strip" is also excellent for all gold alloys.

A point to remember in the making of alloys is that the nearer the proportions the alloys approach one another the harder will be the alloy, so that if an equal amount of silver and copper be found to be too hard the alloy may be made softer by using less copper, adding the amount taken off to the silver.

In the matter of alloys, there are a number on the market: thus we read of red gold alloy, pale yellow, pale gold, Guinea gold and others. The writer has found these very useful where gold is first alloyed, melting only once. But where there is a quantity of scrap to be remelted (and it is not desired to add fresh gold), the resultant melts, especially if in wire form, are hard and brittle and a fierce thing to get up against. This is undoubtedly due to the zinc or other volatile metals used in the making of these alloys, the repeated melting burning them out.

A very good 10-karat alloy that works well for nearly all purposes and stands remelting by reason of the small quantity of alloy used, is, fine gold, 10 parts; silver, 3 parts; copper, 7 parts, and pale gold alloy, 4 parts. A very soft alloy for dies and stamping consists of, fine gold, 10 parts; silver, 2 parts; copper, 3 parts, and alloy, 9 parts. A 10-karat green gold alloy is, fine gold, 10 pennyweights; silver, 11 pennyweights; copper, 3 pennyweights. As in the case of the 14-karat green gold an alloy is also sold by refiners especially made for green gold. Another 10-karat pale gold, used for half-pearl work and for enameling, is, fine gold, 10 parts; silver, 6 parts; copper, 2 parts, and alloy, 6 parts. This last has a tendency to get hard and cracky during remelting, and should always be mixed with a new melt.

Some jewelers prefer to use the purified shot copper for everything in which they use copper. Others use it in wire form, and there are still other manufacturers who insist that the shot is best for polished gold work, while

the wire is the better for enamel work and for the making of solders.* The writer uses the wire for all alloys, finding that the solder flows better. Certainly the form of copper that most readily blends with the gold, either for polished or enamel work, should be used. The only argument in favor of using shot copper is that it is not (within a fine point or two) quite so apt to melt when being soldered.

*At this present moment it is impossible to get the copper wire (pure lake copper), so we melt the shot copper and roll it into wire, as we find that for certain fine wires it has a better grain.

CHAPTER IV.

FORMULAS FOR ALLOYS AND SOLDERS.

Formulas for Gold of Differing Fineness and Color and for Different Uses—Alloys for Enamel Work—A System of Compounding Alloys for Special Work—Reliable Solder Alloys of Different Qualities—Use Highest Grade for Work to be Enameled.

FINE gold is, as we know, 24-karats, therefore, all alloys are fractions, 18-karat being 18-24, 14-karat, 14-24, and so on. In 24 pennyweights of 18-karat gold we have 18 pennyweights of pure gold and 6 pennyweights of alloy. In 14-karat, 14 pennyweights of fine gold, and 10 pennyweights of alloy.

In 236 pennyweights of 18-karat gold we know that 18-24 or ¾ of the amount is fine gold, viz., 236 x ¾ equals 177 pennyweights of fine gold.

The foregoing examples will be better understood in the talk on refining and subsequent recovery of the fine gold, which will be taken up in other chapters. The whole principle in the making of the different karats of gold is to simply take first the number of parts of fine gold indicating the karat quality, and adding alloys of silver, copper, etc., to make up 24; as in 14-karat we take 14 parts fine gold and 10 parts alloy.

While some manufacturers whom the writer has talked with claim that they can mix their alloys better by using the 100 parts fine gold, adding the proper proportions of alloy to make the different karats fineness, yet he (the writer) finds in the long run the previous system works out the best.

Below are given alloys for different karat gold in use to-day in variegated gold goods, in Roman gold, and pale gold (14-karat) for enameling and paving with half-pearls, and also in 18-karat pale gold.

22-karat yellow gold alloy. Fine gold, 22 parts, or 22 pennyweights; fine silver, 1¾ parts, or 1 pennyweight, 18 grains; fine copper, ¼ part, 6 grains; total, 24 parts or 24 pennyweights.

22-karat red gold. Fine gold, 22 pennyweights, copper, 2 pennyweights.

18-karat pale gold alloy as used in Paris and adopted by some of the manufacturers in the United States. This takes a very rich, delicate polish and is well adapted for enameling in fine, transparent enamels. Fine gold, 18 parts; fine silver, 4 parts; fine copper, 2 parts.

18-karat red gold, used in variegated gold jewelry. Fine gold, 18 parts; fine copper, 6 parts.

18-karat polished gold. Fine gold, 18 parts; fine silver, 2 parts; fine copper, 4 parts.

17-karat green gold. Fine gold, 17 parts; fine silver, 7 parts.

14-karat pale gold for enameling and for pearl set (paved) jewelry. Fine gold, 14 parts; fine silver, 7 parts; fine copper, 3 parts.

14-karat polished gold, also for gilding, rose finish, green finish, etc. Fine gold, 14 parts; fine silver, 3 parts; fine copper, 2 parts; pale Guinea alloy, 5 parts.

14-karat hard wire suitable for scarf pin stems, bracelet snaps, etc. Fine gold, 14 parts, or 14 pennyweights; fine silver, 4½ parts, or 4 pennyweights, 12 grains; fine copper, 2¾ parts, or 2 pennyweights, 18 grains; Guinea alloy, 2¾ parts, or 2 pennyweights, 18 grains.

10-karat for polished or Roman gold. Fine gold, 10 parts; fine silver, 3 parts; fine copper, 7 parts; Guinea alloy, 4 parts.

10-karat for pearl pave or close set. Fine gold, 10 parts; fine silver, 6 parts; fine copper, 2 parts; Guinea alloy, 6 parts.

The 17-karat green gold alloy given is used to-day by a manufacturer of variegated color gold jewelry, nevertheless, by reason of the amount of silver it contains it tarnishes more quickly than a higher quality alloy. An

anode of 20 parts fine gold and 5 parts silver is used in the green gold gilding solution, and the same alloy, while, of course, more expensive than the 17-karat alloy, yet is more beautiful in finish and is more lasting. This alloy is 19 1-5 karats; 18 parts of fine gold and 6 of silver makes also a very good green gold, of course richer than the 17-karat, and is used generally.

The writer has found that for certain pieces of enamel work it has paid, in the long run, to have a little higher quality alloy used. Take, for instance, a double English violet, to be painted in fancy shades to match some piece sent by the customer. Under ordinary conditions the regular 14-karat alloy is used, but in this case the number of firings contingent upon getting the exact shade often hardens the alloy, burns the copper, causing oxides, etc., which a little higher karat gold, while costing a little more, will more than offset by the saving in time and labor. Here is a 15-karat alloy that is used and recommended: Fine gold, 15 parts; fine silver, 6½ parts; fine copper, 2½ parts. The writer does not advocate the using of the 15-karat only under the above conditions, as the 14-karat alloy given is excellent for all enamel work, and if enamel does not stay on, chips, flies off, etc., there is some fault in the melting, or in the quality of the copper or silver.

The following are a few reliable solder alloys for use with different qualities of gold:

15-karat solder suitable for 18-karat gold. Fine gold, 15 parts, or 15 pennyweights; fine silver, 5½ parts, or 5 pennyweights, 12 grains; fine copper wire, 3½ parts, or 3 pennyweights, 12 grains.

12-karat solder for 14-karat and 15-karat gold. Fine gold, 12 parts; fine silver, 7 parts; fine copper wire, 5 parts; just before pouring add about 8 grains cadmium or zinc.

10-karat solder for 14-karat and 15-karat work, used in soldering on subsequent parts where article might be spoiled by the further use of the 12-karat solder. Fine gold, 10 parts, or 10 pennyweights; fine silver, 8 1-6

parts, or 8 pennyweights, 4 grains; fine copper wire, 5 5-6 parts, or 5 pennyweights, 20 grains. Add 16 grains cadmium or zinc just before pouring.

8-karat solder used in the last soldering on 14-karat polished gold work. Fine gold, 8 parts; fine silver, 9 1-3 parts; fine copper wire, 6 2-3 parts. Add 1 pennyweight cadmium or zinc just before pouring.

6-karat solder. Fine gold, 6 parts; fine silver, 9 parts; fine copper wire, 6½ parts; brass wire, 2½ parts. Add brass after rest is melted and just before pouring.

4-karat solder, used in repairing and in low grade and doubtful quality of gold. Fine gold, 4 parts; fine silver, 9½ parts; fine copper wire, 7 parts; brass wire, 3½ parts. Add brass last, as in other alloys.

In all work to be enameled over the solder seam or joint, it is imperative that the highest possible quality alloy solder be used. All of the solder alloys given are used to-day by large concerns, and while the writer has experimented with "cyanide" solders, also a special alloy supplied by a maker of a certain alloy which is mixed with the same karat gold as the work in hand, the special alloy burning out on soldering, leaving absolutely no apparent joint, yet these last are not practical for all kinds of work, and are well out of the way. If a 14-karat enamel gold ball made out of two halves is properly soldered with the 12-karat solder it will stand enameling.

The 8-karat and 6-karat solders are for the 10-karat alloys. Would advise using the 4-karat solder very sparingly, as it is obvious that by reason of the small amount of gold used it will tarnish quickly, even under heavy gilding. It is readily seen that with all the correct proportions before us of the different karats of gold, solders, etc., it is an easy matter to get out any desired quantity by simply multiplying all the items by the same multiple. For instance, if we wish to get out a bar of 14-karat enamel gold, say about 240 pennyweights, we proceed as follows: Fine gold, 14 x 10, equals 140 parts, or pennyweights; fine silver, 7 x 10, equals 70

parts, or pennyweights; fine copper, 3 x 10, equals 30 parts, or pennyweights. Total, 240 parts, or pennyweights.

The writer advises always weighing the fine gold off the scales first, then putting on the silver and adding the copper to make up 100. This prevents possible errors; we know we have 140 parts of fine gold and 100 parts of alloy. With these formulas furnished, it is comparatively easy for the jeweler to compound other alloys for his particular work. For instance, for work not to be enameled, a solder of 11 parts fine gold and 13 parts alloy may be used, and a 9-karat solder may be also made, adding the extra silver and copper, so that proportions are not materially altered.

To reduce quality of gold multiply the weight of the metal on hand by the difference between its fineness and the fineness desired and divide the product by the latter. Result will be the amount of alloy to be added.

Example: Reduce 20 pennyweights 18-karat to 14-karat.

$$18-14=4$$

$$\frac{20\times 4}{14} = 5\ 5\text{-}7 \text{ pennyweights of alloy to be added.}$$

To increase the fineness: Multiply the weight of the metal by the difference between the baseness, that is, the number of parts of alloy in the gold in hand and in the quality desired, dividing the product by the latter. The result will be the amount of fine gold to be added.

Example: Increase 20 pennyweights 10-karat to 14-karat. The difference between the baseness or alloys is

$$14-10=4$$

$$\frac{20\times 4}{10} = 8 \text{ pennyweights fine gold to be added.}$$

CHAPTER V.

GETTING OUT PLATING STOCK.

A Particular Piece of Work when Bars Are of Good Size—Care Necessary in Annealing—Work must be Absolutely Clean—Tubing for Bracelets—Eating Out with Acid—Keep Close Watch of 10-Karat Goods.

TO successfully get out plating stock is a little more difficult than would seem to the average beginner in this branch of the making of jewelry. The main points, however, are to have the two metals to be soldered together face up true (no wobble) and be perfectly clean. Now the man who gets out a small piece of stock for a small job will very likely say, "It's a cinch," and he possibly will find it so; but let him prepare a bar of some seven inches in length by about two in width, the base metal or composition 1425 points thick and the gold 475 points, making a combined thickness of half an inch, and he will have some job on his hands. Before the seamless tubing came to be almost universally used in the making of bracelets, bangles, and some other jewelry, the factories made their own tubing out of plate, hence the necessity for plated stock on a large scale. While still later methods are now employed in the bending up of hollow work, yet the plated stock will always be necessary in the making of certain goods.

Brass, copper and other base metals are sometimes used as the backing, but there is a special plater's metal sold by the American Oil and Supply Co., of Newark, N. J., which eats out readily in the acid and is specially prepared for this purpose. If a sufficient number of bars be purchased, you can have them cut any length and width or thickness desired. This is a point worth remembering in the getting out of stock, to so utilize the

material as to use all, or nearly all, and avoid the frequent refinings necessary to recover the gold. Concerns specializing on hollow work make a variety of goods, so that a narrow strip left over after cutting off a bangle may be drawn into hollow wire for knot brooches or scarf pins, chatelaine pins, etc.

The gold and the base metal plates after being rolled the thickness before mentioned, are placed together in a piece of sheet iron exactly the same length and which has been bent up "U" shape, leaving one side of the "U" longer for convenience in handling with the tongs, and placed in the furnace for annealing. A large vise should be near at hand, the jaws of which are fitted with steel plates about 5-16 in. thick and at least as long and wide as the plated stock. When the metals are red, remove and place in vise and screw up tight. Care must be taken not to get too hot, running the risk of perhaps melting the gold, or partly burning in on the base metal.

After removing from the vise, the plates are boiled out in dilute sulphuric acid "pickle," dried and filed with a *clean* file. From now on the greatest care must be taken in order to avoid getting even a blush of grease on the plates. See that your rasp or file is not oily, nor has a fleck of beeswax on it. The plates should be handled with tissue paper to keep from the touch of the fingers. After filing, go over with a sharp scraper and finally finish by describing a sort of lattice work with the point of the scraper. The solder is of plate, rolled as thin as possible, about five or six points in the dial screw gauge, scraped carefully, and after evenly painting over with well-rubbed borax and water, to which a drop or two of grain alcohol may be added, is laid on the base metal in strips.

The solder should be of the best quality: for 14-karat work 12-karat solder is used, and for 10-karat plating 8-karat is the best. The reason for this is that lower grade solders tend to burn in and rot the alloy; furthermore, the joint or sweating is better with the high quality solder, it works better in rolling and stands

up better in the eating out in the acid. The plater's metal is left a little wider than the gold and the solder projecting makes it easier to watch the soldering process. The gold bar placed on the base metal is put in between two iron plates of about ¼ inch thickness the length and width of the stock, bound tightly with heavy iron binding wire and placed in the muffler. An ordinary gas annealing furnace will do, but the gas of the muffler can be controlled and regulated much better. As soon as the solder runs remove at once, and, taking in tongs, place again in vise; remove and after boiling out, if directions are carefully followed, you should have a good bar of plating. The stock may be rolled to any thickness wished. It is usually gotten down to about 225 points for bangles and thinner for smaller work. The rolling and annealing should be done by a careful man; the annealing is more frequent than in the case of all gold stock.

Plated stock on a much smaller scale is made by the steam blowpipe, observing the same general rules in preparing. In the case of green, red or yellow gold plating it is better to use 250 points to 600 points thickness of backing. When we say red gold we mean an alloy of gold and copper only, which is almost as soft as the other colors.

In painting on the borax, if a shiny spot or spots show and seem to persistently refuse to take the borax, keep rubbing until the plates, both solder and all, are evenly coated. The shiny spots are usually grease and must be rubbed or scraped out to ensure the flowing of the solder. The argument has been advanced that wire or thick strips of solder placed on one edge and drawn through is a better way. This may serve in small stuff, but does not work in the getting out of large bars.

Tubing is also gotten out by drawing the gold over the base metal and, as in the case of bracelets, winding iron wire around before bending up on the arbor, to keep the seam from buckling or opening up. A great many manufacturers to-day make their own tubing of the

drawn-up seamed hollow wire, claiming that in the long run they are better off; the seamless tubing developing thin spots oftentimes, which makes the profitable working of it uncertain. In the winding up of 6 millimeter width bracelets, or wider, that are of round wire, it is advisable to put a brass hollow wire in the centre. Do not use solid wire, even if you should find it necessary to draw up plate so that it is apparently solid (no hole in the centre); the acid will soon find the joint and attack the base metal more readily. If the brass core is not used, the tubing will flatten in the winding on the arbor and an oval shape will be the result.

Bracelets are now made by using gold hollow wire, carefully wound with iron wire and filled with sand well packed in so that there are no air spaces for buckling; bend the ends of the tube over before winding. Some shops use cement in place of the sand, with a series of gas jets to uniformly heat the tubing, and using a sort of squirt gun which injects the melted cement into the warmed tube. The sand, however, is the best arrangement.

Small work like spring rings are made in quantities by drawing up hollow wire of about 35 to 40 points and carefully soldering by using a thin wire of solder rolled flat and sprung in the seam, then wound on a grooved arbor. The rings come out slightly off the round, almost cushion shape in fact, and are then, after sawing apart, placed in a press having top and bottom plates hollowed out to shape up a perfect round. This brings the shape back again and the spring ring is finished up with the jump ring, snap, spring, etc.

As mentioned, strips left over are rolled thinner, say to about 175 points, drawn up into tubing and bent into chatelaine pins or hairpin ornaments. The tubing, especially when it is to be drawn into widths of 6 millimeters or less, should be first filed on a bevel so that when it rounds up the gold edge will come together. Before putting it in the acid all work should first be shaped to the desired design. Bangles and bracelets should be

cut to size, soldered, and rounded on the arbor. A few holes drilled on the inside greatly facilitate in the eating out, and, especially in 10-karat work, the quickest way of getting out the base metal must be used. In 14-karat work nitric acid C. P. and hot water in equal parts may be used. In 10-karat work use 3 ounces nitric to 9 ounces hot water. Keep acid working; one shop the writer saw had an ingenious arrangement of a steel bar suspended from an arm in the end of the shafting; as the shaft revolved, the bar would pound on the bench on which were the vessels with the acid, thereby keeping it in motion.

Fresh acid should be put in every two hours, carefully pouring off the old into a large crock for the subsequent recovery of the silver from the solder. All 10-karat goods must be closely watched, as, by reason of the large proportion of alloy, there is danger of the acid attacking gold or rotting it. Under no circumstances leave in over night, and as soon as all bubbling or effervescence ceases, showing that either the acid is saturated or that the base metal is eaten out, pour off acid at once, then rinse first in *cold* water, and finally in hot. To still further kill traces of the acid the work is now boiled in a strong solution of water and ammonia.

While plated stock is perhaps not used as much as it was some ten years ago, yet some fine jewelry is still made in this way, notably knurled or bead-edge link buttons and studs, beads and balls of various sizes and shapes. The greatest fault usually is in the eating out, the tendency being to leave work in the acid over night, consequently, nearly always in the case of 10-karat work, resulting in spoiled goods.

CHAPTER VI.

WIRE DRAWING AND WORKING.

Melting the Gold—The Best Alloys and Their Proportions—Steel Arbors for Ring Winding—Paper Wrappers for Oval Arbors—Cutting and Closing Rings—Making Twist Wire.

IN melting gold for wire it is generally the custom to use scrap gold or that which has already been in the crucible two or three times. The reason for so doing is that we get a harder and tougher wire, more spring, etc. This does not always follow, however; where the prepared alloys are used a fickle bar of gold oftentimes results, especially if gold has already been melted twice; does not roll well, develops cracks in spite of frequent annealing, and yet after being broken down is softer than may be desired. The best alloys to use for wire are silver and copper only, with the fine gold, and generally in the proportion of twice as much copper as silver. An alloy of fine gold, 100 parts; fine silver, 24 parts, and copper, 48 parts, will make, after three meltings, an excellent 14-karat wire, and is used for knife-edge work.

A bar of this alloy should stand a light hammering on the anvil and rolling to about two-thirds of its original thickness before annealing. If it shows deep cracks right at the start it must be remelted, using plenty of sal ammoniac, and if still brittle remelt, using about half a teaspoonful of corrosive sublimate. Be careful not to inhale the deadly poisonous fumes.

Always examine after putting through each draft for possible cracks and file out at once before they are allowed to get deeper. Before drawing through the steel plates be sure to well cover with beeswax. The best way to do this is to melt the wax in an iron ladle and then dip in coil of wire, which has previously been

warmed. If draw plates are kept in a clean drawer or box and are at intervals well washed in kerosene they will last much longer and give smoother wire.

Steel wire is best for arbors for winding rings on, but if some sizes are hard to get, German silver or brass may be used. This is drawn from a thicker wire, so that it is very hard. In making oval rings the arbors must be steel to stand the frequent annealings. Always wind thick wrapping paper around an oval arbor before winding wire, or else you will have difficulty in getting rings off after annealing. In making rings it is a good plan to mark sizes, arbors, number of thicknesses and style of paper used on oval arbors, in a book for future reference.

Be careful in sawing off rings so as to get a good joint. Rings are made flat and closed by placing on a smooth, flat die and tapping with a hollowed-out punch, which draws ends up tight. Another way is to use a die with a V-shaped hole in which rings are placed; a brass punch is put over ring and tapped with hammer.

The fine rings used in rope chain are first drawn to extreme small sizes by diamond, agate or sapphire draw plates, after getting down as far as practicable in the steel ones. After winding on arbor they are cut by putting on another wire which has a piece of watch mainspring inserted in the end so that it sticks up enough to act as a sort of knife. The cutting edge is sharpened and the wire is fitted snugly into hole of a draw plate and sharply pulled with a pair of draw tongs. The rings are caught by holding in a bottle while process is going on. In the same manner the half-ring trimming used in Etruscan jewelry is also cut; in this case, of course, letting "knife" project on both sides. Great skill is necessary in having knife of exact thickness, so that after cutting rings they will be opened the right space for linking up. This is particularly important in rope chainmaking. In making twist wire of two or more strands be sure that wire is well and closely twisted, always remembering that in subsequent working of the twist, winding rings, or other manipulating, that the

twist unwinds a little, and if not well twisted in the first case will result in a scrawny, spready twist.

In cutting a piece of stock from plate to be used as wire, always cut the same direction as the grain runs, or, in other words, cut the way gold was put through rolls. The rather too common practice of cutting a strip off the "end" generally shows up a number of broken rings, or else cracky, seamy ones in winding.

CHAPTER VII.

THE MAKING OF SOLDERS.

Reason for Using Copper Wire rather than Shot Copper — Components Should be Proportionately Like Those of the Stock—Best Solder for Easy Flowing is within Two Karats of Stock it is Used on—Process of Melting and Mixing.

COPPER wire is used instead of shot copper in the making of solder by reason of the "grain" in the wire, which permits of an easier flowing solder.* Shot copper is used by some manufacturers, however, and for the work in hand gives good results. This wire is pure lake copper, and may be purchased from Reichhelm & Co., New York. The ordinary commercial electric copper wire, used for wiring, etc., contains traces of arsenic, lead, tin, iron, antimony, etc., and is not recommended. The copper wire for alloying is already drawn to the desired thickness, about one-eighth of an inch, and is bought by the pound.

In the soldering of jewelry it is imperative, to get the best results, that a solder of which the component parts are as near in proportion as those of the goods to be put together be made, and also that the highest possible quality solder be used. Another thing: if a 12-karat solder, made of gold, silver and copper, is employed to solder a 14-karat article in which the alloy is made of gold, silver, copper and alloy (of almost any kind), your 14-karat stock will melt almost as soon as the 12-karat solder. This teaches us that an alloy composed of more items melts more easily and at a lower temperature.

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*See previous note, Chapter III.

In the making of solders it is not advisable to use more than three component parts, viz.: Gold, silver, and copper (unless it be a low-grade solder for repairing), as, although it will flow easier, yet it is more brittle, rots in frequent solderings and is affected by the pickling solutions; so that, no matter what alloys may enter into the making of your 18-karat, 14-karat, or 10-karat stock, use only the gold, silver and copper solders. Add a few grains of cadmium for 12-karat and 10-karat goods, with an addition of brass for the 8-karat, 6-karat and lower grade solders, used for 10-karat and repairing. Now the easiest flowing solder is that made within two karats fine of the stock you are working on. This is because the work has to be heated to almost melting point before the solder will run and when it does flow a perfect blending is assured. Low-grade solders will not flow or run on high quality work, simply because the solder runs before the work is well heated. The solder, therefore, simply melts "lumpy," and if additional heat is applied starts to burn out and "rots." The whole principle in fine soldering is simply using as high a quality of solder as possible, reserving the "repair" solder for a possible break at the last minute.

The alloying of gold in the making of solders, or, for that matter, in the making of stock, is not merely putting the right proportions into a crucible, waiting until it is melted, and then pouring into the ingot— it is a little more than that. Copper or alloy melts at a lower temperature than silver, so put in these metals first, then cover with the silver, and lastly cover well with the gold. It is obvious that if the copper or the alloy were put in last it would be melted and partly burnt out before the silver and gold were melted, thus making a brittle and also a higher quality solder than intended by reason of the copper burning out or volatilizing. The few grains of cadmium used merely assists in making solder flow more easily, and is not considered in preparing the alloy, as it burns out after soldering. When the metal is melted, which can be ascertained by inserting an iron

rod, poking down under the charcoal, by the way, any gold which is on top and seems to stick, stir vigorously, let stand a few moments, stir again, turn off gas, and just before lifting out to pour, add the cadmium, using a small pair of tongs and putting in well under the charcoal, then pour as speedily as possible. Some of the old-timers use zinc (pure) in place of cadmium, especially in melting for cast work.

It is a pretty sight to watch an expert caster as he handles the liquid metal, adding the tiny pellets of zinc at just the right instant before pouring. This zinc adding can be easily overdone—a "smitch" too much and a brittle casting is the result. It also gives the gold a pale color. The great point in its favor is its making the molten metal more "watery," insuring a perfect casting. Where zinc is used, get the rods used in plating batteries.

The proper time to add the cadmium is a matter of experience, it depending on the amount of metal, etc., but a few directions in a general way will help. Gold, silver and copper melt at a much higher temperature, so that these mixed metals must be allowed to cool before adding the cadmium — when the crucible begins to show a dull red in the furnace, is about right. Do not, of course, let it get too cold, so that the mass solidifies before pouring. As before stated, powdered (fresh) lump sal ammoniac and willow charcoal powder are best for melting, using about half and half, adding a little more charcoal after gold is melted. Use enough to well cover in both cases.

In the making of new work where the karat quality is of course known, no solder less than four karats lower should be used, or five at the outside. An 8-karat or a 6-karat solder is only used as a matter of expediency, but is not recommended in working on 14-karat goods. No brass, zinc, or cadmium should be used in making of any solders over 12-karat, and in this latter very sparingly, —about 8 grains to 24 pennyweights of solder. In the solders where brass is used the wire form is best, and may be purchased from any hardware store. It is cut

into about half-inch pieces, and, as in the case of the cadmium or zinc, added after the other metals are melted and poured as soon as mass is thoroughly mixed with the iron rod. Brass is merely a mixture of copper and zinc, hence the necessity for quick pouring. A black smoke rising from the crucible will advise us that the brass is melted and is burning out.

In addition to solders already given, here is a very easy flowing 6-karat solder: Fine gold, 6 pennyweights; silver, 8 pennyweights; copper wire, 6 pennyweights; zinc, 4 pennyweights. Also a solder 2½ karats fine: Fine gold, 2½ pennyweights; silver, 10 pennyweights; copper wire, 7½ pennyweights, and zinc, 4 pennyweights. Not less than 24 pennyweights total of either of these solders should be melted.

CHAPTER VIII.

SOLDER AND THE QUALITY STAMP.

Stamped Products of Reliable Factories Make Close Assays —How to Figure Karat Quality—Solder Formulas Should be Verified—Alloy for Filling Shells—Benefits of the Stamping Law.

MOST jewelry factories of any standing and rating stamp the karat quality on their goods, and if a piece were assayed, it has generally shown better than 13-karat in the case of 14-karat stamped jewelry. Of course, in a solid wedding ring, or a pair of flat links, where there is practically no solder, the gold should assay 14-karat. In hollow work, where two halves are soldered together, it is well to know just how much gold is used and also how much solder.

Take, for instance, a belt pin, when the front is applied to the back and soldered. We are using, say, 12-karat solder. Weigh the gold parts, with joint, catch, and pin tongue, before any solder is sweated on, and weigh again after pin is made. The difference in weight will, of course, show how much solder is added. Now, presuming the clean gold weighed four pennyweights of 14-karat gold, and twelve grains of 12-karat solder is added, knowing that in every pennyweight of 14-karat stock there are fourteen grains of fine gold, and to every pennyweight of 12-karat solder there are twelve grains of fine gold, we find that in the four and a half pennyweights of both we have sixty-two grains of fine gold; and to get the karat quality we divide by 4½, which gives us 13 7-9, which karat the pin would assay.

Now, the using of file solder in hollow work, in the hands of indifferent or incompetent workmen, is a serious proposition in that some of them fairly "slob" the solder on, using enough on one pin in some cases to

solder probably half a dozen. Where the price is already fixed, this, in the first case, is simply giving away gold, and in the second case, the karat quality of the pin is being lowered considerably, so that if it were assayed it might not test better than 13-karat or even less. In some hollow work, not for enameling, as low as 8-karat gold solder is used and the solder must be used as sparingly as possible to keep above the 13-karat mark.

Large manufacturers, making match boxes, vanity boxes, lorgnettes, knot brooches, etc., where the parts are first flushed with solder and then sweated together, in order to offset the lowering of the standard quality, use an alloy from one-quarter to a karat finer than is subsequently stamped.

In view of the fact that a lot of formulas furnished by refiners, copied from books, foreign publications, etc., simply tell how to get or make a hard solder that may be used for 18-karat work, or 15-karat, or 10-karat, as the case may be, neglecting to advise you of the karat quality, the writer strongly urges the jeweler to find out what grade the solder is before starting. Suppose you should ask for a good, hard solder that will stand enameling on 14-karat new work, and a correspondent furnished you with the following: Fine gold, 5 pennyweights; silver (fine), 2 22-24 pennyweights, and copper wire, 2 2-24 pennyweights. Add up the items and your total will be 10 pennyweights; in this, 5 pennyweights of gold have been used, so that the quality is 5-10 of 24 fine, or 12-karat solder. These recipes furnished by trade publications in response to inquiries, are usually copies from foreign trade journals, and, while generally correct, yet the writer has known of instances where mistakes have crept in either in translating or in the printing.

In reply to an inquiry sent in some time ago, a New York trade journal furnished the following gold solder for 18-karat work: "Fine gold, 120 grains; fine silver, 36 grains, and fine copper, 2 grains." This solder is 18 18-79 fine, or better than the 18-karat it is proposed to use it on. Going on, the article says: "For 10-karat

solder use fine gold, 140 grains; fine silver, 70 grains, and fine copper, 75 grains." This is 140-285 of 24-1, or 11 15-19-karat solder, instead of 10-karat. An 8-karat solder turns out to be 7 7-11-karat, the proportions published being, "fine gold, 140 grains; fine silver, 170 grains, and fine copper, 130 grains."

Sometimes in the course of manufacturing the jeweler is called upon to make a solid piece of work, where ordinarily the pattern is made hollow. In many cases it is not practical to take a heavy solid piece of gold and strike it in the die, so a special alloy, of same karat quality, is made and used as a solder or filling for the regular shell. A head of an animal is ordered, but must be solid all the way through. The usual process is gone through of raising it out of the regular stock, only that the fewer number of items that are allowed in the alloy the less chances there are of melting when the "filling" is subsequently applied. A 14-karat alloy of 14 parts fine gold, 3 parts fine silver, and 7 parts fine copper *shot* will permit of a 14-karat solder consisting of fine gold, 14 parts; fine silver, 6 parts; fine copper *wire*, 2 parts; pale Guinea alloy, 2 parts, and about 12 grains of zinc (pure) or cadmium. In both instances the alloy is 14-karat, the 12 grains of cadmium or zinc not counting, as in the soldering it burns out, being only put in the alloy to aid in the flushing of the solder.

A 14-karat solder for 14-karat work is not recommended for general practice, as it is too brittle for soldering parts, and the relative proportions of the alloys entering into its composition are not close enough to the 14-karat goods used. As before stated, the best solders are made of alloys using as near as possible same proportions as the alloy of the gold you are working on.

The recent stamping law enacted in New York state is practically a life saver to the legitimate manufacturer, forcing the other fellows, as it does, to make their linings, inside posts, various stiffenings, connections, etc., of plump karat quality as stamped. These same makers used formerly to apply silver or other metal caps inside

of link buttons as bearings for the settings of the stones, while the connecting bars were of 8-karat stock. First-class stores did not hesitate to buy these goods, presuming, doubtless (if they ever gave it thought), that "Jones" was figuring his goods at a little lower profit than the old reliable house of "Brown & Co." It is the writer's experience that the best policy in the long run is to make plump quality goods. One may go merrily along for a number of years shutting his eyes, or indifferent to the amount of solder or other karat quality entering into the making of jewelry, but upon a suspicion being entertained the goods are tested, and upon being found of low quality it is a mighty hard proposition to get customers' confidence again.

CHAPTER IX.

SOLDERING.

Parts Must be Kept Free from Oxidation — Nothing Better than Slate Borax for This Purpose—Setting Up the Parts —Use of the Blowpipe—Various Ways of Using Fluids —Economy in Using "Nests"—Clamps for Setting Up.

THE whole secret of successful soldering is simply keeping the parts to be united free from oxidation during the heating and running of the solder. There are a number of preparations for this purpose on the market, but the old-fashioned slate borax is as good as any and better than some. A "soldering fluid," put up by Schneider, of Newark, is very good, especially in the case of soldering parts to be enameled over the seam. This fluid prevents pin holes and is easily applied. As soon as the article is successfully flushed, the heat must be removed or the solder will commence to burn out. For gold work the borax is rubbed up on a slate rather thin, but in silver jewelry it should be the thickness of cream, and the silver should be well scraped before applying the solder. To prevent the blistering and rising of the borax during heating, "Borum junk" is rubbed up with the borax. Some jewelers mix a little gum tragacanth, which has been previously dissolved in boiled water, in with the borax; others mix a little powdered boracic acid in their water bottles. Keep your borax slate clean. A teaspoonful of grain alcohol in an 8-ounce bottle of water helps to cut the borax up better in the rubbing up.

Firms making low-price silver and rolled plate goods set up the parts in ordinary mucilage or glue on sheet iron forms, then borax the joints, apply the solder and heat, using steam blowpipes. These are fitted to each workman's bench, and by covering the entire bench

with a sheet of asbestos a quantity of work is "charged" and soldered at once. Speaking of the blowpipe, it is very useful in any shop, as, for instance, a fine piece of work which has been set up in wax and plaster Paris poured over it, after settling and hardening, is heated by the steam or power blowpipe and then soldered by the aid of the mouth blowpipe.

All work must be free from any traces of oil or dirt, and should be annealed and boiled out before soldering. Rolled plate jewelry is boiled in a solution of boracic acid and water before soldering. Get a pound of this acid and put in a gallon jar or crock filled with water, take your boiling pan, or an ordinary galvanized pan will do, and place work in, well cover and boil well; pour back the liquid and thoroughly dry the work, and a film of boracic powder will be coating the work. Use an easy flowing solder—fine silver, 40 parts, and brass wire, 20 parts, is good, adding the brass after the silver has been melted, remembering that the silver is melted under a good layer of charcoal powder, a small piece of borax added after it is melted, well poked down under the charcoal, then the brass quickly shoved in, well stirred with an iron rod and poured quickly into a heated ingot mould. It is well to keep in mind that rolled plate stock will not stand many annealings, especially the 1-40 stock, so figure out your soldering accordingly.

Another way to apply the anti-oxidizing fluid (boracic acid) is to take a glass jar, well stoppered, fill about half full of boracic acid, and the balance with pure grain alcohol. Just before using, shake well and dip, or paint work with a small camel's hair brush and ignite over a flame. The joint to be soldered is then scraped, borax applied, and it is ready for soldering. In resoldering a number of times, it is advisable to freshly coat the work each time, as the glaze is liable to burn or chip off. In all cases the boracic acid is applied before any soldering is done; the joint for soldering is scraped clean and the regular borax applied as in ordinary soldering. Still another way is to rub up an equal quantity of yellow

ochre and boracic acid with a piece of slate borax and apply to the work. Great care must be exercised in this last method in keeping the ochre from the soldering joint. In fine close work, like the jointing of lockets, etc., ochre or powdered rouge, rotten stone or powdered tripoli is used to prevent the joints from soldering together. One very good jeweler, whom the writer has met, used to use the juice of an onion. As this last "kink" did not facilitate any, nor was any easier to use than the first mentioned methods, the average workman may be easily excused for not wishing to be constantly inhaling the odor of this pungent "fruit."

As in the case of borax in place of most of the hard soldering fluids, there is nothing any better than the zinc muriatic acid mixture for soft soldering and repairing of all kinds of work. Get pure zinc clippings from your plumber and add to the muriatic acid until no more zinc is dissolved. Towards the end place on your sand bath and use a gentle heat. Be sure that some undissolved zinc remains. This insures the complete "killing" of the acid. Now pour off carefully into a glass-stoppered bottle and add about one-third 20 per cent liquid ammonia and a little water. This solution will not rust the bench tools. For certain new work, such as the assembling in emblem work, where the soldering acid might tarnish, Venice turpentine is used. This is made by dissolving resin in turpentine gradually, well stirring from day to day until it is of the consistency of a syrup. Parts are well scraped, the "Venice" and solder applied; and after soldering the work is plunged into alcohol, which removes the scum and cleans work as new.

Occasionally the finisher is called upon to do a soft solder job, a setting to be soldered in a brooch, for instance. This is best done with the small copper soldering iron, which is heated by placing in a fork over the gas flame. The better run of factories, as a rule, never use soft solder in fastening in any settings or parts, usually either burnishing or screwing them in. In this respect a wide contrast in methods is observed, as in the case of

the very finest diamond jewelry imported the foreign workmen seem to take a delight in "plastering" settings, parts and sections together with soft solder. The prepared charcoal soldering blocks are now generally used in place of the ordinary burnt charcoal. Right here is an expense item that can be kept considerably lower by the use of "nests," made from layers of mosquito netting, or iron wire coiled. Always see that an asbestos pad is used wherever feasible. Some workmen have a habit of using the charcoal block for everything, from annealing a piece of steel to soldering a fine, delicate "set up" of wire work. It will be found that a great saving will be effected in the course of a year if the block is used only when absolutely necessary. In fact, for a great deal of work good jewelers prefer the "nest," as a quicker and better heat can be obtained.

Workmen should be taught and encouraged to make sheet or iron wire clamps for holding parts together to be soldered. Old-timers, that is, some of them, will fritter away a whole day sometimes in tying a few joints and catches on to brooches, when the whole job can be done in an hour by another man who has used his head a little. The "pickle" used in boiling out work after hard soldering is the ordinary commercial sulphuric acid and water, in the proportion of about a half-cup of acid to two quarts of water. Add the acid to the water carefully. This pickle is used for work under 14-karat and for all silver jewelry. For 14-karat work an "acid" made of four ounces of nitric (C. P.) acid and one gallon of water is used. This, after boiling the work in, cleans it and also sharpens up the solder joints, removing a little of the solder. Good quality solder should be used to avoid "rotting." In rinsing, cold water should first be used to kill the traces of acid or pickles, then the hot water, after which dry in sawdust.

CHAPTER X.

TIPS ON SOLDERING AND STONESETTING.

Twist Wire Border for a Cameo Brooch—Applying Trimmings to a Plain Flange—Setting Soft Stones by Hammering—Sandblasting and Coloring—Never Use a Hot Solution—The Bezel Setting.

TWIST, shot, or other wire is soldered around a cameo brooch or other mountings by first making a twist wire ring, soldering the joint with hardest solder and gently shaping on a round or oval mandrel until it fits snugly to the brooch. Now, touch lightly with thin borax water in about six places and apply pellets of solder of easy running quality. Apply an even heat all over brooch, being careful to run solder first on side farthest from twist wire joint. The solder should be rolled very thin and cut very small. Tacking in five or six places will hold wire securely.

Where it is practical, or where a twist wire is made Roman and put around a highly polished mounting, the wire is simply snapped or forced on, being held only by friction. Where it is sometimes desired to put around more trimming, say a shot wire, a plain wire and also a twist wire, soldering on to a plain flange all the way round, the plain bezel with the flange is polished first with tripoli, washed out, then annealed and boiled in pickle. Now rub up a clean mixture of borax and water and apply evenly all over the brooch. Anneal, let cool, place on the trimming, and apply borax with a brush to the latter.

The fact that the plain flange is protected by a coating of burnt-on borax will insure soldering and at the same time keep the solder from "splashing" or running where it is not wanted. The solder of course should be of a lower quality than that used in soldering on the bezel

and the flange. If the directions are carefully followed and the solder applied evenly it will run in underneath the wire and after boiling out in pickle a clean piece of well soldered work will be the result. Should a few spots not be soldered, borax carefully, apply solder, let dry, then paint as close as you can with a mixture of yellow ochre and water to keep solder from running where not wanted.

The fine twist wire ornamented work noticed in earrings, belt pins, hat pins, etc., is all done by applying the "trimming" on to an annealed borax covered background, the tiny pieces of trimming, be they twist, plain wire, shots, rosettes, etc., being moistened in a weak solution of gum tragacanth and water; after drying, the work is gone over with a sprinkler in the shape of an old toothbrush dipped in borax and pressed with the fingernail. File solder is now applied by means of an arrangement in the shape of a pipe, the stem notched so that the nail in scraping along causes the solder to spray out of the opening.

* * *

The hammering or burnishing in rings of soft stones, as coral, turquoise matrix, opals, etc., is a matter of skill and long experience and also adaptability for this extremely patience-requiring style of work. Setting in silver is, comparatively, not so difficult as with gold. If the tips here given are carefully followed, however, you should meet with some success. In making a gypsy ring, or other style where stone is to be hammered in, leave stock heavier than it will be after finishing. File as slantingly as you can to the setting, as the more raised or pointed the edge the better are the chances for hammering over on to the stone.

The stone should be fitted very snug, the ring being firmly cemented on a shellac stick. Some setters prefer to do the hammering, holding the stick in a vise, while others have a boy help them. The latter method is safe, as it enables the setter to get closer to the job. Small

flat head punches are used and the hammering must be light. Work evenly all round the stone and after securely fastening in and testing by means of a piece of wax (placing a piece about the size of a walnut on the stone and sharply rapping the stick on side of bench) the ring may be filed and smoothed. Setters as a rule do not cover the stone, but a varnish of alcohol and shellac will afford a good protection, drying, as it does, in a few moments. Barrett or safety back files are used and the smoothing for polishing is done with a Scotch stone and water.

Where work is to be sandblasted all soft stones must be covered, using strips of tissue paper dipped in the shellac alcohol mixture. Wherever it is practical in the making of rings or any kind of jewelry where a bezel is first made for the stone, this setting should be 18-karat; an alloy of 18 parts fine gold to 4 of silver and 2 of copper is excellent. The slight cost of using 18-karat stock is more than made up in the saving from breaking of stones.

Jewelry with soft stones should never be put in a hot gilding solution. The writer has seen opals sometimes come through all right, but it is risky. Use a cold bath, or one nearly so, and a stronger current. The solution is generally made a little richer also when used cold. Some work where stones are burnished in may be rose finished or colored before setting. Paint over with the shellac varnish, except just the setting edge. If neatly burnished the setting may be given a frosted and finished effect by touching with a glass brush or gently rubbing with small pointed pieces of emery paper, thus doing away with the necessity of further gilding.

The later styles of jewelry show stones held in by a fancy claw or scroll. These prongs are made out of soft gold. Still other pieces are set from the back, the stone being held in by a few claws on back of the pin. Of all the soft stones the turquoise matrix is the most tricky, and this stone is very seldom hammered in. A very good effect of this style of setting is gotten by letting in a nar-

row 18-karat bezel to the ring so that an edge sticks up just enough to turn over on the stone. If smoothed off carefully the ring looks pretty much like a hammered-in stone job. The chief thing to look out for is a clean soldering so that no pinholes or specks show up at the finishing.

The shellac may be removed by placing in wood alcohol. All rose finished or colored work should not be given final scratch-brushing or relieving of raised surfaces until the last thing.

CHAPTER XI.

REPAIRING STONE SET WORK.

A Delicate and Trying Problem—Always a Risk in Heating Stones—Easy Method of Protecting Stones while Soldering—Some "Secret" Methods—Remove Jewels for Enameling or Hard Soldering.

TO the jewelry repairer, the most delicate and trying problem presented is the soldering of broken parts with the stones left in. A ring, pin, or other article comes in, the break perhaps just far enough removed from the stone to give rise to the question, "Will it stand the heat?" The writer wishes to say right now, that where a stone, no matter what it is, can be removed, do not put it through the fire. This applies to diamonds, rubies, sapphires, and emeralds, as well as the other stones. It is better to stand the cost of resetting the stone, especially if it is a large one, than to have to furnish a new one occasionally. The four stones mentioned will admit of being heated red hot, and in most cases come out all right, yet it is risky; stones with flaws are apt to crack still further or get "salty" or dull. Where it is advisable to take the chance, these stones should always be coated with boracic acid dissolved in alcohol and ignited, so as to form a coating during the subsequent soldering.

It is a matter of record that some diamonds are more susceptible to heat than others. The writer knows of diamond chains where twenty and more stones are soldered in little bezels, in which they have, in some instances, become dulled during the soldering, necessitating a repolishing at the diamond cutters. They were taken from one lot of stones of the same grade and quality, and to all intents and purposes were expected to mount as clean as the others. Some jewelers claim that the pre-

pared charcoal block upon which they solder the links emits a vapor which dulls the stone. There may be some truth in this, yet it does not explain why the diamonds in an enameled piece will sometimes get white and lifeless when being "fired" in the enameling furnace on a repair job. At all events, the diamond jewelers simply accept the situation in as philosophical a manner as possible, and if sometimes, after going along merrily for a few weeks, they run into a bunch of hard luck and "scorch" a few diamonds, they are sent to the cutters for repolishing.

It may be asked, "Why cannot the diamonds be set after the soldering?" Replying to this question, the most delicate mounting and one showing the minimum amount of metal is the half-round girdle which is snapped around the stone and soldered, with the connecting rings afterwards applied, to make the chain. In soldering rings, if the break is at the bottom of the shank, or not too near the shoulder, and the shank is not too thick, nearly all stones can easily be protected by wrapping thoroughly wet and "soggy" tissue paper around the stone or stones and well pressing on with a pair of spring tweezers during the soldering. A very quick flame must be used so as to avoid drying the paper and spoiling the stones. In stones like onyx or others that are cemented in a box, it is best to remove them. The stones most susceptible to heat are the coral, turquoise, pearl, opal, then follow the amethyst, topaz, peridot, tourmaline, and others of about the same hardness.

Speaking of tissue paper as a protection during heating, the writer is reminded of some of the "secret" methods employed by various workmen in protecting the stones and gives them here for what they are worth. One jeweler used to bring a potato every morning to set his work in for soldering. Another would mix up whiting and water and cover the stone. Still others swore by wet sand, yellow ochre, or plaster of Paris. Take two sheets of tissue paper, the older and more crinkly the better, fold up five or six times so as to make two strips

about a foot long and an inch wide, well moisten with clear water to make a saturated mass, wrap around the stone, perhaps first packing in crevices and back of stone with small pellets. You can use this same paper and will have a dozen rings or other pieces done while the other fellow is puttering along with his potato or turnip, or paste pot.

Some years ago we remember a very good workman who was struggling along trying to solder a five-stone opal follow or hoop ring. He had dug out a cavity in his charcoal block and filled it with whiting paste, then he had placed the ring too far in the mess and had patiently shaped up a piece of charcoal to fit inside the ring. After about an hour and a half he reported to the foreman that the stones would have to come out, that it couldn't be soldered. Another man took the ring, cleaned off the whiting, put away the charcoal, wrapped around a strip of wet tissue paper, used a quick flame, and the job was done in ten minutes. On the other hand, discretion is also a very valuable asset. A firm on Fifth avenue had to stand the loss of a $1,500 pearl simply because the workman took a chance on sizing a lady's very small ring with the pearl in. How much saner it would have been to have had it removed, even at the cost of a new mounting.

Diamond set work to be re-enameled should first have the stones removed. One is taking a risk otherwise, and, as said before, a dozen pieces may come through all right, while the next job, with perhaps a dozen or more stones in, will go to the bad and your profit is gone on the previous dozen jobs. In protecting the stones, if you should decide to take a chance, see that the boracic coating is well dried and heated so that any bubbles or flakes will have been cleaned off before charging on the enamel.

In soldering on new clamps or points on cluster or set rings where stones are left in, always cool gradually. Stones have been known to break by dropping onto a cold slab or metal while in a heated state. Any stone with flaws should never be put through the fire unless at

the owner's risk. A good axiom to remember is that it is always better to talk about a thing two or three times before than once afterwards. And another thing, do not get into the soft soldering habit. If a customer brings in a job all plastered with lead tell her about it and estimate what it will cost to put it in first-class condition. She will probably have it done at some store eventually, as the fact of her bringing it to you has shown that it will not hold soft soldered.

Hard solder your work, get your men used to removing jewels and replacing them and they will take more pride in their work and themselves. You can stand back of your work and guarantee it. Soft solder is easily removed by first scraping off all you can, or heating carefully and brushing or knocking off, then let stay in a solution of muriatic acid and water in proportion of about two of acid to one of water, until the solder is destroyed. Do not let it stay in longer than necessary, as low-grade gold is apt to get affected by the acid.

There is nothing that will bring back the lustre or color to any of the semi-precious stones after being burnt, so bear in mind that an ounce of prevention is better than any amount of cure.

CHAPTER XII.

THE PROCESS OF GILDING WITH ELECTRIC CURRENT.

Preparation of Gold Chloride—Proper Manipulation of the Dynamo—Making Ready Solutions for Roman, Rose, Green, 14-Karat Gold, and Silver Plating—A Few Practical Hints on the Care of Stock Solutions.

NO solution, however carefully made, will be of any use unless the dynamo is regulated to the amount of work to be gilded. Get a dynamo that will give from one-half a volt up to six volts, also get a voltmeter and rheostat to raise or lower the current, and you are equipped for anything that a large jewelry factory calls for. A large water tank with a capacity of three crocks holding one gallon each and heated by a steam coil gives best results; always keep tank filled up to within an inch of top of crocks and heated to 120° to 150° F. From 1 to 1½ volts will be found enough current for small batches, Roman and silver plating, running up to 3 and 4 volts for the other finishes; the exact current strength, however, must be found out by actual experience, as strength of solutions will vary as used, on difference in temperature, etc., also in number of articles to be gilded. All work must be free from any dirt or grease and should be scratch-brushed with a fine brass brush on a rapidly revolving spindle, keeping article wet by allowing a solution of bran water to drip from a tank or can placed just above the brush. The bran water should be freshly made each day, and is made in 1 gallon lots by dissolving a couple of handfuls in an old salt bag, in boiling water, then squeeze out well and it is ready for use.

To make the gold chloride take 20 pennyweights of chemically pure gold, which can be bought in ribbon

form, or, if you have an old anode, roll it very thin and cut up into squares; then crinkle it so it will not lay flat, place in a flask with a long neck and mix a solution of four ounces chemically pure muriatic acid and two ounces of C. P. nitric acid; put all in flask and place on sand bath; the gold will dissolve in a short time, but should be left on the sand bath until the solution evaporates down to almost a syrup; let cool and add one-half pint of distilled water; let it evaporate again, then pour into a bowl containing about three quarts of water, stir well and add carefully liquid ammonia (at least 20 per cent) until all the gold is precipitated as a spongy mass in bottom of bowl; be careful not to add any more ammonia than is necessary. Now pour off liquid and wash the gold several times with boiling water until all odor of ammonia has disappeared, then wash once in cold water.

A word of caution to the beginner is necessary at this point, as when the gold is thrown down by the ammonia it becomes fulminating gold and if allowed to become dry is a dangerous explosive. A little water should be left in bowl after each washing and after final cold water rinsing. A solution of three ounces cyanide of potassium (C. P.) in one quart of water should at once be poured on gold and let stand over night; should all the gold not be dissolved, add a little more cyanide and water from time to time until solution is a clear golden color and all the gold is just dissolved. To get out any slight impurities, carbonates, etc., the solution should now be filtered, using filtering paper shaped to fit the glass funnel resting in a crock or earthen pitcher. We now have cyanide of gold ready to be used in the making of Roman, rose or English finish and green gold solution, and also to replenish with from time to time.

To make a Roman solution, take one-quarter of your cyanide gold, place in gallon crock and fill up to within an inch of top with rain or distilled water, or water that has been boiled and allowed to cool may be used. Then mix 12 pennyweights phosphate of soda in a little water and add, stirring well. Use a C. P. gold anode, one

about six by two inches, and the thickness of a twenty-five cent piece, raising or lowering this anode in the solution in proportion to the quantity of the work, usually getting the best results by having a little more anode surface. If, in the making of the cyanide of gold, you have used just enough cyanide potassium to dissolve the gold, it will be necessary, in the making of the gilding solution, to add one-half ounce of cyanide so as to have free cyanide in the bath.

Work after scratch-brushing should be dipped in a bowl of hot water, in which a few drops of ammonia or a small piece of caustic soda may be dropped. This is done to clean the work and also to heat it up to about the temperature of the gilding bath and is a point worth specially remembering in gilding enamel work, as the sudden change from the cold bran water of the scratch-brush oftentimes causes the enamel to chip and fly off. The current should be allowed to circulate through the bath for a little while before using a new solution; best results are secured on the following day.

We are gilding, say, six brooches of the average size; see that your copper wires are clean and well rubbed with emery paper; note the current registers one volt; after scratch-brushing well and dipping in the hot water bowl, suspend in the bath by means of thin copper wire,—do not use iron wire,—let stay in about half a minute; remove and scratch-brush well, hang in again for three-quarters of a minute, remove, scratch-brush and give a final dip of about a quarter of a minute, when work should be gilded. It is advisable to defer the final scratch-brushing until after the brooch has been set, pin tongue fastened in, etc. If gilding is too pale, there is either not enough gold in solution, too much free cyanide, or not enough current. If too dark, muddy or reddish, the bath is too hot, too rich in gold, too much current, or not enough cyanide of potassium. All the above will be found out by actual experience and can be remedied by following the hints given.

The beautiful so-called "English" or "Guinea" finish

is obtained by highly polishing and rouging the work, then washing out in ammonia and soap water, well rinsing off, dipped in a rock potash bath and immediately into the regular Roman solution. If a quick dip is given, a rich yellow shade is imparted to the work. Certain grades of work, like chains, shell links, etc., are also "Englished" by gilding in the regular way and placing in tubbing barrels which revolve laterally and are filled partly with a soapy solution and steel balls.

A rose gold solution is prepared the same as the above, adding carbonate of copper previously dissolved in water and cyanide of potassium, a little at a time until the desired shade is secured. Use a current of three to five volts; the solution should be hotter than regular gilding bath, but not boiling. For rose finishing first gild,—two coats only,—then place in rose solution only long enough to get the shade wanted; finish the work, then scratch-brush the back, dry in sawdust, and just before carding brush the raised parts lightly with a glass brush. A rose finish may also be obtained by using the regular gilding bath and running up the current, but this is an expensive method, as the gold is deposited heavily or "burnt" on, and the practice is not advised.

It sometimes happens that in spite of the greatest care in the manipulation of the dynamo, baths, etc., the gilding is not satisfactory; in such an event, where, say, a cigar case or a large locket is not taking an even, rich color, place in a silver bath and then regild, when you will find a beautiful lustre will be the result.

In the making of a green gold solution we use cyanide of silver in addition to the gold. To make this more care must be exercised than in preparing the gold, and is done as follows:

Dissolve one ounce of fine silver (rolled thin and crinkled, as in gold) in an evaporating dish containing enough nitric acid (C. P.) and water in equal parts to cover it. If not all dissolved, add a little more acid and water until just dissolved, avoiding an excess of acid. Evaporate cautiously to dryness to expel the acid and

dissolve the powder (silver nitrate) in a quart of distilled water. Now dissolve 15 pennyweights of cyanide of potassium in about six ounces distilled water and add in small portions to the silver nitrate solution with brisk stirring; let stand until a precipitate ceases to form in the clear liquid. If too much cyanide is added, some of the silver will be redissolved. Pour off the liquid and wash the precipitate several times with water. Dissolve 25 pennyweights of cyanide of potassium in six ounces of water and pour on the silver gradually, stirring well with a glass rod until about half of the solution has been poured; let stand for 12 hours, stirring occasionally, if silver is not all dissolved; add the solution a little at a time until nearly all the silver is taken up, then put in a glass-stoppered bottle and place in a dark closet, ready for use in the making up of silver plating solutions and in green gold baths.

A green gold bath is made by taking a regular gilding bath and adding the silver cyanide carefully until a green shade is reached. It is well to take some old silver or metal pins and practice on them; when you get a rich, deep green, lacquer it and keep for comparison from time to time. If you get too much silver cyanide in the bath the gilding will come out pale and eventually white, so that more gold cyanide must be added. Use a green gold anode, 20 parts fine gold and 5 parts silver. A rich green is also obtained on a single article by first silver plating it and then suspending it in the regular Roman bath; touch the current copper rod and remove instantly.

To get the dark green shade or "smut," take 12 pennyweights of powdered white arsenic, mix in a little water to form a paste, then boil in an enameled iron pan with one-half pint of water and one ounce of cyanide of potassium; let cool and add this arsenic solution very carefully, not more than a teaspoonful at first, and later drop by drop, until at a current of three volts a deep, dark shade shows. More arsenic makes work black, and upon relieving the high lights shows a pale, lifeless green.

In this case it is generally better to make a new solution. If at three volts a dark smut is showing and it is desired to get a still deeper black, the current may be run up to three and one-half or four volts. Do not leave work in longer than necessary to get the shade, then plunge at once into boiling water, dip in alcohol, let dry, or ignite and burn off the alcohol, relieving the high parts last, as in rose finishing.

A silver solution is made by taking half of the silver cyanide, put in a gallon crock filled with water, add one ounce of cyanide of potassium and stir well. The solution may be used hot or cold, using more current in case of cold. If color is yellow, add a little more cyanide. Use fine silver anode.

To make a 14-karat solution, add to a regular gilding bath the carbonate of copper solution, testing from time to time, until, after burnishing the article with a bloodstone burnisher and rouging, the color matches a solid 14-karat piece. A little silver cyanide may also be added. The amount of copper to be added is regulated by current strength and other conditions, which can only be determined by experience.

In the amounts of "free" cyanide given, the proportions are a little under, as it is an easy matter to add more. All solutions should be filtered once a month and fresh cyanides of gold or silver added in small quantities from time to time to keep baths from becoming impoverished. Remove anodes when through gilding, as the cyanide will dissolve them. A little phosphate of soda should be added occasionally to tone up the baths. Solutions not in use every day should be kept in glass-stoppered bottles. All solutions containing gold should, after they have been run for some months, or are spoiled, be poured into a large crock, and when there is sufficient quantity, say ten or fifteen gallons, the gold may be recovered and melted in with the refinings. The latest and most economical process for the recovery of old gold and silver from solutions will be taken up in another chapter.

CHAPTER XIII.

RED GILDING.

The Proper Bath—Strength of Current—The Best Anode—Dynamo vs. Batteries—Preparation of the Work—Avoid Excess of Free Cyanide—Copper Cyanide Solution—To Preserve Goods from Tarnish.

TO get a good red color copper must be added to the gold bath. This is best done by first dissolving carbonate of copper in water in which a small piece of cyanide of potassium has been dissolved. The amount of this cyanide of copper solution to be added to the bath is, of course, determined by the size of bath, amount of gold it contains, current strength used, etc.

In all events, add copper carefully, a little at a time, until the deposit shows red. For red gilding, the bath should be somewhat hotter than for yellow or Roman, although not boiling; the current is increased to about three volts. A 14-karat anode is the best to use, and is made of 14 parts of fine gold to 10 parts pure copper shot. Some platers prefer to use a 10-karat anode, and still others use platinum or copper anodes. To have a permanent even bath, however, and to deposit a red that will not tarnish quickly, an anode of not less than 14-karat should be used. In the case of the 10-karat and copper anodes there is constant danger of getting too much copper in the bath, and with the platinum anode it is a matter of frequent replenishing of the solution. The regular pure gold anode is also sometimes used, and in this case, with the stronger current especially, you are "burning" up considerable fine gold.

All this would be found out very quickly if large lots of work were being constantly put through the plating room. Now the deposition of gold and copper in solution upon metal articles is more difficult than where only

one metal is to be deposited. It is a matter of having just enough of each metal so that with a sufficiently strong current, right amount of free cyanide, good hot bath, and goods to be plated absolutely clean, both metals will be deposited in the proper proportion.

To get best results, a dynamo with a voltmeter registering six volts should be used. Cell batteries or ready-made gilding outfits supplied to the trade are makeshifts and are always unsatisfactory in the long run. You must have an indicator to show you that when you have "shoved" up the current, it has been increased, and also exactly how much. A voltmeter is the only thing that does this, and saves guesswork.

Work should be scratch-brushed with a steel brush, using bran and water. In the baser metals, especially oreide or brass, the work should be first dipped in a hot potash solution, scratch-brushed, then dipped (after stringing on clean copper wire) into a bowl of hot water with a few drops of ammonia, and placed in the bath. Leave in only for a few seconds for the first dip, then remove, rinse, and scratch-brush with a fine brass brush. If some of the parts are not covered, rebrush with the steel. The article must be thoroughly coated before proceeding with a second and longer dip.

If a good, durable "plate" is desired the second immersion should be of at least a minute, gently keeping in motion while in the bath, and turning so as to present all sides to the anode, in order to secure an even deposit. Articles should then be burnished with a bloodstone, or a highly polished steel or agate burnisher. Heavy deposits are secured by extra dips, scratch-brushing and burnishing after each dip. In order to know amount of gold being deposited weigh the article carefully before starting. If, no matter what you do, the color is pale, it indicates too much free cyanide or not enough current; if muddy, the current is too strong, there is not enough free cyanide in the bath, or the solution is impoverished and needs more gold.

Where there is too much free cyanide the gold is rap-

idly dissolved from the cathode as soon as it is covered, and until there is enough gold eaten off the anode to balance the bath, the metal of which the article is made is also being dissolved and there is danger of spoiling the solution. This, of course, is particularly true where the baser metals are being plated. A good plan is to take a piece of highly polished 14-karat plate and match the gilded piece. When, after burnishing, the shade is the same, keep it for future reference.

Remember the redder it is the more copper, and consequently the lower the alloy. In making the cyanide of copper solution get about half a pound of copper, place it in about a quart of water which has been previously boiled and cooled. Add small pieces of cyanide of potassium from day to day, until all the copper is dissolved and a clear liquor shows. More or less cyanide could be used, but you would not know just where you were at. The principal thing in gilding or plating is to get a good deposit with just as little free cyanide as possible. A little more can always be added; in fact, it is a good thing where a quantity of work is done daily, to add a small piece each morning. In new solutions the current should be run for a little while before commencing to work with it. When you have once secured a good solution do not use it for any other purpose. Keep in glass-stoppered bottle when not in use. This solution can be safely used for a rose finish after goods have first been gilded in the regular Roman bath.

All solutions that have been worked daily should be filtered at least once a month, and oftener where work is of a mixed nature, presenting more opportunities for the introduction of foreign matter, sand, dirt, etc. Get good quality filtering paper and a large glass funnel, twist up paper to fit snugly, adding a few pieces to the opening of the funnel stem, as the weight of the liquid may force the paper through otherwise. Let filter into a thoroughly clear vessel—a large pitcher does very well. The paper should be kept and burned up eventually with the shop sweeps. A solution properly kept will run from four to

six months before becoming played out. It is then poured into a crock, in which may be kept any cyanide solutions, for the subsequent precipitation and recovery of the gold and silver. It is a good idea to so regulate the making of solutions that new ones are made after Christmas and during the summer vacation.

There is nothing that will prevent goods from eventûally becoming tarnished in the showcases. This is due to the vapors (mostly sulphur) that generate and readily attack silver and also plated jewelry, and even solid gold articles after a time. Gum camphor will, in a measure, neutralize the poison of these oxidizing gases; a piece of magnesia will also absorb some of the impurities. A solution of chloride of lime placed in the cases each night will prolong the subsequent recleaning of the stock. Tarnished silverware may readily be renewed by dipping in a crock containing water and a few pieces of cyanide of potassium. Rinse and dry in boxwood sawdust and bring up the lustre by holding against dry cotton buff on rapidly revolving polishing lathe. Colored or matt finish gold goods may be cleaned by dipping in bicarbonate of soda, 2 ounces, with about an ounce each of chloride of lime and table salt in one pint of water.

In using cyanide of potassium remember it is a deadly poison, and always label any vessels containing it as such.

Polished gold jewelry is touched up on the rouge brushes and buffs. Work with half-pearls in — first cover the pearls with a paste of powdered magnesia and water and let dry. This keeps pearls white and prevents the polishing rouge from getting under the stones. This paste could also be used on any article where it is not desirable to have rouge come in contact.

CHAPTER XIV.

RESISTS FOR TWO-COLOR WORK.

Acetate of Amyl and Celluloid Solution the Most Satisfactory—How It is Prepared—Protection of Parts in Bright Polishing—To Remove the Resists—Pegging on Parts—Bronze Powders.

TO protect parts of lockets or other jewelry, before immersing in Roman or other gilding solutions, first gently warm the article over an alcohol lamp (do not get it hot), then paint with a small camel's hair brush dipped in a solution of acetate of amyl and celluloid. The amyl acetate may be purchased at any druggist's; the celluloid is added, a little at a time, left over night, and more added from time to time, until the solution is of the consistency of a fairly thick lacquer. I would suggest using the plain yellow celluloid — a couple of combs may be purchased in any department store.

This lacquer should be applied by going over once only with the brush, letting it dry thoroughly, then giving it another coat and letting dry. If the article is kept just warm it will greatly facilitate the drying. When dry the lacquer is colorless and transparent, though it is sometimes desirable to have it colored so as to enable one to see where the stop line is. For this purpose a little finely powdered rouge is well mixed in. This "resist" is kept in a well-stoppered glass bottle, a few ounces lasting a long time.

This solution will stand up longer in a cyanide of potassium solution than any others the writer has tried, yet it is not advisable to keep articles in the bath longer than absolutely necessary. When possible, work with cold or lukewarm gilding solutions. As is known, cyanide of potassium is a most deadly destroying agent, and if

the article to be given a Roman or other dip be left in any length of time the lacquer will be attacked and consequently the exposed parts will also be gilded. In the case of a Roman color the bath may be worked cold; for rose or green gilding the solution must be hot. Get it working exactly right before putting in the "resist" covered pieces.

Other work is finished bright in certain sections by first giving the jewelry a Roman dip and then polishing away the color so as to expose the bright gold underneath. The gilded parts in this case are protected in some instances by painting over with gamboge and water or a paste of powdered magnesia and water, or, where feasible, a brass foil is struck up in the same die that the article was raised in, and the parts to be bright sawn out. This brass is then fitted over, acting as a protection to the gilded parts. Of course, all lapped or raised parts may be polished bright after gilding without the aid of any of the above-mentioned protecting agents, and in the hands of skillful and experienced polishers some very quick finishes are given. To get the lacquer off after gilding, let the article stay for a short time in a steaming hot solution of caustic potash, or a lye dip will do.

Another resist is the ordinary lacquer used for silver work; another is asphaltum dissolved with a little beeswax in turpentine. This last is removed after gilding by immersing in benzine. Still another resist is the ordinary shellac varnish made by dissolving pure amber colored flake shellac in wood alcohol and applying with a brush. You will find, however, that the solution first mentioned will give best results for all kinds of work.

In gilding work where two or more finishes or colors show on the same piece, always use the strongest or most difficult solution first, as in the case of, say, a locket which has a green colored section or background with a Roman colored face. First green finish the proper or desired shade, dry well and apply the lacquer resist; the yellow dip may now be easily applied in a comparatively cold solution.

In expensive platinum and gold goods it is sometimes advisable that certain parts be finished and pegged on after gilding. These pieces are usually fastened on by means of soft gold hollow wires. These hollow wires, after passing through the main section of the piece, are held by carefully burnishing, or spreading the ends.

Bronze powders dusted on, are still used in cheap jewelry. These powders may be bought from the jewelers' material houses and come in every color and shade.

CHAPTER XV.

ACID COLORING.

An Old-Time Finish still Used in Special Cases—Difficulties of the Process—Etruscan Work and Gold Bead Necks Best Finished in This Way—Details of the Work—Some Good Formulas—Tricks of the Trade.

THE acid color finish of gold jewelry is not applied as much as it was some twenty or more years ago. In some respects this process of coloring is not practical. Most of the old-timers can remember the trouble connected with the resizing of acid colored rings and the refinishing thereof, or the "chipping" away of the color in setting or engraving. Likewise the repairing and recoloring of brooches or other jewelry. Briefly stated, the ingredients of the mixture employed in this process have a powerful solvent action on the base metal with which the gold is alloyed, and a weaker action on the gold itself, so that the base metal is dissolved from the surface, leaving the fine gold thereon. This fine gold surface will, in time, become scratched, or a repair necessitating soldering is needed with a subsequent recoloring.

To properly recolor the article, it should first be finely smoothed off with emery paper so that the original alloy surface is reached. The fine gold being removed, the copper coating is exposed, and this being also taken off, the alloy will be seen. By alloy we mean the karat quality gold of which the article is made. Now all this means a reducing of thickness and a consequent weakening of the piece, and a second recoloring would probably entirely spoil it. In soldering acid colored work it is best done by painting entire piece with borax and water, soldering with an easy flowing solder and recoloring in regular gilding solution. Sometimes a strong current is

needed to force a deposit of fine gold on acid colored jewelry. Another difficulty encountered in the attempt to recolor old jewelry by the acid method is the lack of knowledge of proportions of silver and copper in the gold, the maker of the article in question knowing, of course, his alloy, uses more or less acid in proportion to amount of silver used.

Certain styles of goods, however, can be brought to the highest state of perfection only in this way, and to-day makers of these lines of jewelry use the acid color finish. Especially in the case of Etruscan work is the acid dip necessary to make the trimming—be it shots, twist wire, plain or fancy wire—stand out clean and sharp from the background. Plain gold bead necklaces are best finished in acid color, as the color is more lasting, the electro-gilding being apt to rub off or become dimmed from continued contact with the skin. Another good point is that the maker of acid colored goods is giving a plump, solid alloy; it wouldn't stand the acid if otherwise, and in the case of the afore-mentioned beads, there is a tendency sometimes to use a plated stock in order to facilitate the getting out of the bead.

This base metal is supposed to be entirely eaten away by acid before making into necklaces or other jewelry. The lace work made out of screw wire rolled flat and bent into various patterns is greatly enhanced by the acid finish, the cutting of the screw being sharpened and given a finer and richer look.

Gold to be used in acid color work should be largely alloyed with copper; red gold will color better than the pale. The excess of silver in alloys renders the subsequent color pale, and while more muriatic acid is used, yet it were better to avoid all this by using as red an alloy as possible. A good 14-karat alloy consists of fine gold, 14 parts; silver, 3 parts, and copper, 7 parts. If this should be found too soft, a harder alloy may be made by using 4 parts of silver to 6 of copper.

In acid coloring goods of a lower quality than 14-karat it is absolutely necessary that the alloy should

largely be of copper and the solution an old coloring 14-karat mixture, in which a quantity of work of that karat has been acid colored. The reason is that the base metal would be attacked to such an extent as to weaken or destroy the goods before a desirable color had been attained. As before remarked, the gold is also slightly attacked in 14-karat work, so that old 14-karat solutions contain more or less gold. It being a well-known fact that copper is electro-positive to a gold solution, the latter is deposited on the former upon immersion, the coloring of the low-grade work hastened and the loss in weight reduced to a minimum thereby.

Acid coloring was originally done with plumbago or black lead crucibles, or sand crucibles, and sometimes even a thick porcelain cup or bowl has sufficed. All this was superseded by the platinum vessel, this last being the cleanest and safest method of mixing and holding the color. Platinum, at the time of its introduction in this line, about thirty-five years ago, was $6 an ounce, and a 30-ounce color pot was not considered expensive. At this writing, with the same metal soaring around $100 to $105 per ounce, it is more practical to hark back to the lead crucible, although one may have nickel pots with a platinum lining made. With care, the lead or sand crucibles will give as good satisfaction.

To get bright, snappy results in acid color work, the article should be polished. Where this is not feasible the piece, as in Etruscan work, should be smoothed with finest emery paper before soldering on the trimming. Work should be well boiled out in pickle after last soldering and all acid or pickle gotten out of hollow work by holding over an alcohol lamp. Work is then tied in small bunches with silver or platinum wire, handled as little as possible and annealed black; this is best effected in an enameling furnace, or the ordinary gas furnace will do, being careful that no foreign substance gets on the work.

There are all proportions of formulas on the market; the following is recommended: Saltpetre, 12 ounces,

salt (table), 6 ounces, muriatic acid, from 3 to 5 ounces, in proportion to silver in alloy.

The first two items are well pounded in a mortar and placed in a lead crucible which has been previously warmed; stir well with a piece of hard wood or a wooden spoon for a minute or two. Then add acid in about one ounce of boiling water, the mass being constantly stirred until it boils to the top of the pot. The heating is best done over a gas burner placed in a forge or under some good flue arrangement to carry off the fumes. The gas is recommended, as it can be better regulated than other methods of heating.

The pot should not be less than 8 inches high and of good breadth. As acid boils up, place in the work, which has been first dipped in boiling water and well shaken before dipping. Keep work moving, but avoid touching sides of the pot. After about three minutes remove and plunge in boiling water, then into a second vessel of the same. Then add to your color in the pot 6 fluid ounces of hot water and when it boils up again, immerse work one minute, rinse as before, and if color does not suit, repeat the operation, adding more hot water to the color pot each time, finally rinsing in clean hot water and immediately putting in warm, clean boxwood sawdust.

This amount of color is for 6 ounces of work of a fairly compact nature. If the goods are spready, as hollow wire work, not as much as 6 ounces should be put in, and in solid, heavy work, like chain, more than 6 ounces can be colored.

Manufacturers making acid colored jewelry have little pet secrets for getting fine rich finishes, and, of course, continual coloring affords them opportunities to get on to little "tricks." One method is to boil for a few seconds in the liquid *only* of the solution after work has been scratch-brushed. Another is, during last dip add a teaspoonful of finely powdered alum to the coloring salts. If a deep orange tint is desired, a teaspoonful of sal ammoniac instead of alum will do it. The acid in hollow work, after drying in sawdust, should be killed by dip-

ping the goods in a dilute solution of ammonia water. The work is then scratch-brushed, using a fine brass brush, kept for this purpose, and moistened with clean bran water. Some colorers put a few drops of muriatic acid into first rinsing vessel. It is well to work with as little acid as possible.

A better color is usually gotten on bright, clear days, and when the wind is anywhere but in the east. Work should not be immersed longer than enough to get a good bright color; avoid handling, or a spot will show; always thoroughly dry in sawdust before brushing. The beginner is advised not to attempt any "tones" in finishes until he is somewhat experienced.

A fine, bright yellow will show if first directions are carefully followed. The muriatic acid must be chemically pure and kept in glass-stoppered bottle. The satin effect, as on beads or plain gold pins, etc., is obtained by sanding evenly all over before annealing. The subsequent final scratch-brushing must be done very lightly. The solders should be of the highest possible karat quality, it not being advisable to use lower than 9-karat solder for 14-karat work, although 8-karat is sometimes used to solder on back parts, joint, catch, etc.

CHAPTER XVI.

PRECAUTIONS IN THE COLORING ROOM.

Proper Equipment is Real Economy—Not All Colorers Realize Dangers—Strong Draft Necessary to Carry off Fumes—Handling Fulminating Gold—Keep Acids in Locked Room—Antidotes for Cyanide Poisoning—For Poisoning by Other Acids or by Alkalies.

IT is a subject of deepest concern that many jewelry manufacturers are absolutely indifferent in the matter of equipping their coloring rooms with proper appliances and apparatus for the drawing off of the acid fumes. To the disinterested person this must seem, to say the least, foolish on the part of the employer, as well-trained, experienced colorers and gilders are hard to replace when one is finally incapacitated from inhaling the cyanide fumes or those of other acids. The writer, in the course of some twenty-five years, has been in some of the largest fine gold houses in New York and vicinity, and in nearly every instance has found the tank, with the various crocks of solutions, steaming so that the vapors are being constantly inhaled by the work people. Men and women have been forced to give up positions because of their health being impaired.

Now, this is all wrong and unnecessary. Of course, it is more or less understood that the gilder is familiar with the poisonous nature of his solutions, and if he is willing to take the job, why, it is "up to him," yet it is a regrettable fact that most of these colorers, both men and women, are *not* thoroughly posted as to the deadly contents of their crocks and oftentimes get careless. In a good many cases the formulas are compounded in the factory office by the superintendent or foreman.

The gilding should be done in a room or a part of the factory where a hood is placed over the tank containing

the crocks of solutions. If there is not enough draft through the pipe leading from the hood, attach a pipe from the blower so there is a forced draft. In other words, see that there is enough suction to carry up small pieces of paper. The gilder should be impressed as to the danger of getting any of the solution in the eyes, or in cuts or scratches, or, in fact, on the person at all. A bottle of rose water kept conveniently at hand is excellent as a neutralizer, especially in getting in the eyes, and a little rubbed on the hands after each day's work will keep the hands and arms clear from nasty red spots. This is but a trifling expense, and the little thought on the part of the employer in this respect is appreciated by the average workman. Clean, cold water should always be kept at hand, the colder the better. Do not use hot water, for the reason that the cyanide will be given fresh impetus for damage before it is eventually dissolved in the water. Should one be overcome by the fumes, rush at once to an open window, apply ammonia to the nostrils and send for a doctor.

As one gilder puts it, whose book on gilding the writer has read with great interest, "Once a gilder, always a gilder." There is a fascination about it that appeals to a great many, but it is pitiful to see those who have been at it a number of years made physical wrecks simply from lack of a little decent consideration. The offices are usually fitted up with all the latest appliances in the way of window ventilators, fans, air shafts, etc., and yet there is a fearful yelp if the request is made for a comparatively inexpensive blower to carry off deadly fumes that are endangering the health of a number of people daily.

Every once in a while we read of an explosion in the coloring room from fulminating gold. In this case it is nearly always carelessness of the man whose duty it is to make the solutions. Fulminating gold is the fine powder precipitated by ammonia from gold dissolved in aqua regia. Pour off the liquid carefully, so as not to disturb the gold, and fill up with boiling water *at once*, repeat with several washings, until there is no odor of

ammonia, then wash once with clean, cold water and immediately make into cyanide of gold solution, as described in preceding chapters. Now the point to keep in mind is that under no circumstances should the gold be allowed to get dry; even the little on the edge of the bowl should be brushed back into the bowl with a wet brush. Always leave a little water in bowl after each washing. Better be over zealous, seemingly, on the safe side. Only a short time since a man was seriously injured by removing the lid of a crock containing fulminating gold. It appears it had been left over night and some of the gold had dried on the lid.

The refining, or acid coloring, or the dissolving of gold or silver in acids, should be done in a place by itself, or a room separated from the factory. If not done out of doors there should be a large forge place or big chimney, large enough to place the vessel right in. The men should be carefully cautioned not to inhale any of the fumes, and in the pouring of acids from carboys into bottles, to be absolutely sure that the bottle is first empty and rinsed out. The room containing the acids should always be locked, and entered only by careful and trustworthy employees. Long association always has a tendency to make people careless. One man had been working in the rolling mills so long that he thought they wouldn't hurt him, and one day three of his fingers were taken off as a result. It is pretty often so in handling acids, and the foreman cannot keep too sharp a watch during any process involving the use of them. Of course, accidents will happen, but a large number of them could be prevented. Always remember to have plenty of *cold* water handy, get to the pure air, and as an antidote give a few drops of ammonia, besides allowing the person overcome to inhale it also.

Referring again to the cyanide of potassium used in gilding solutions it is worthy of note that five grains, or a quantity about as large as a pea, is sufficient to kill a strong man. There have been cases known where people have been killed from simply inhaling the fumes.

If any solution containing cyanide is swallowed, cold water should be run on the head and spine, and a dilute solution of iron acetate, citrate or tartrate administered. If hydrocyanic acid vapors have been inhaled, water is applied as above and atmospheric air containing a little chlorine gas should be inhaled. Another remedy for cyanide of potassium getting in cuts is to well rub with olive oil and lime water after first washing in cold water. For poisoning by alkalies—caustic soda, potash, etc.—take weak solutions of sulphuric or nitric acid, a few drops in water only, or vinegar or lemonade; after about ten minutes take a few teaspoonfuls of olive oil. In poisoning by nitric, muriatic, or sulphuric acids, drink plenty of tepid water, or swallow milk, whites of eggs, calcined magnesia, or chalk and water; if these acids are spilled on skin, apply whiting and olive oil. Weak solutions, as before said, may be washed off with plenty of cold water.

In concluding this chapter, the writer begs to impress upon the gilder the necessity of caution in handling the solutions; keep the lids on crocks not actually in work. Rinse hands and arms and face frequently in clear *cold* water; use rose water often; get fresh air from an open window as much as possible, and if you find your health is suffering, give up the job at once, before you get too old to start at something else.

CHAPTER XVII.

SILVER AND ITS ALLOYS FOR JEWELRY WORK.

The Use of Silver in Filigree and Enamel Work—Qualities of Copper and Zinc as Alloys—Melting Over Causes Brittleness—Refining of Scraps—How the Metal Should be Melted—Formulas for Various Purposes—A Metal Capable of Many Finishes—Tests for Silver.

PURE, or fine silver, by reason of its softness, is used chiefly in the making of filigree and lace work. In enamel jewelry, where stiffening pieces of sterling silver or a baser alloy are soldered on, it is sometimes advantageous to use fine silver as the background for the enamel. This will insure better results in lustre and lessen danger of chipping the enamel in subsequent finishes. All goods stamped sterling should be 925-1000 fine, or, in other words, 925 parts fine silver and 75 parts of alloy. It has been found, however, that for some purposes the sterling silver is too soft, and the proportions have been changed, even to the extent of using 200 parts alloy and 800 parts of fine silver. In this case it is best to use fine silver in parts of the article so as to make it assay sterling. Silver is much more ductile than alloyed gold and costs less in raising in dies, there being practically no "spring" in annealed sterling silver.

In alloying silver, copper is extensively used, the chief reasons being that the latter metal has about the same characteristics as silver, melting at about 100° F. higher, is a soft, malleable metal and mixes well. Its great objection is that it oxidizes, and to-day certain manufacturers are using zinc, cadmium, bismuth, nickel, etc., in place of it. Great care must be exercised when zinc is used, as it volatilizes and burns out; in using it as the alloy the silver is first melted under a good coating of powdered willow charcoal; the zinc, which must be

chemically pure and rolled out thin, is added by poking it quickly in under the charcoal, then pouring as rapidly as possible. It is best to add a few extra grains of zinc to allow for loss by volatilization.

Sterling silver, no matter what alloy is used, should never be melted more than two or three times, as the alloys burn out, oxides form, and the silver becomes, although a better quality than sterling, hard and brittle and is useless for stamping or working. Add new silver with proper amount of alloy to your sterling scraps, or where it is not desirable to get out more silver, collect all the scraps, filings and old silver, run it down in a crucible, granulate and dissolve in C. P. nitric acid to which has been added an equal quantity of water. This is best done by using an evaporating dish in a sand bath over a gas burner. Add the acid and water carefully; if the action gets too violent and threatens to spill over, add cold water and turn off gas. When silver is all dissolved pour into a large crock nearly filled with water, and throw in a few handfuls of salt (table salt). This will precipitate the silver as a chloride. Let it stand over night, pour off liquid, well wash the precipitate with several changes of hot and finally with cold water; then metallize by dropping in a couple of pieces of sheet iron and pouring in a solution of one part commercial sulphuric acid to nine parts water. Stir well occasionally, and in a couple of days the silver will have turned black. This is now thoroughly washed to remove all traces of the acid, placed in an iron pot over a fire and dried. It is then mixed with flux (20th century is excellent), using about one-quarter by weight to three-quarters silver. Melt in a large sand crucible, let it cool, lift out of furnace and when cold break; a button of fine silver will be found in the bottom. This may be remelted in a regular black lead crucible and cast in ingot or granulated, as desired, and is ready for alloying.

If the various processes are carefully carried out, the silver should be bright and shiny and easily bent. Some manufacturers who keep silver constantly on hand, using

it for refining only, melt and granulate as it comes from the metallizing crock. This does not purify it, the silver showing a dirty, dull white, and as it is used over and over again, it is obvious it is gradually absorbing more and more traces of other metals. The flux will burn everything foreign out of the silver that may have escaped the nitric acid bath.

Silver is not an easy metal to melt as it has the faculty of absorbing oxygen, causing "spitting" and resultant blisters after cooling. It should always be melted under a good layer of charcoal powder, and should not be poured too hot; when ready, pour as quickly as possible. In the working of silver do not anneal your work too hot. Many a good bar of silver has been condemned as "no good," "blistery," etc., when it has been the fault of the workman letting the silver pieces, in process of raising, stay too long in the annealing furnace, thus overheating the work, the air getting in and bringing up a surface of minute blisters. As soon as a dull red shows, turn off gas and let cool.

In melting silver with alloys of a higher temperature, it is a good rule to always put in alloys first and well cover with the silver. This will help prevent oxidization. Always stir well, using a heated iron rod, and make sure that the alloys are melted as well as the silver. Where nickel is used, roll out very thin, anneal and crinkle up before putting in crucible.

An excellent formula for sterling silver for general work and enameling is, fine silver, 185 pennyweights; copper, 15 pennyweights. A hard silver (not sterling, of course) is made of fine silver, 100 pennyweights, copper, 25 pennyweights. The copper used in all alloys must be the very best, either purified shot copper or wire. Some manufacturers find the wire best in all cases. In any event the wire is best in making solders. A hard silver, suitable for snaps and stiffening parts is made of 21 parts fine silver and 2 parts nickel.

A very hard silver solder for sterling silver: Fine silver, 80 pennyweights; copper wire, 20 pennyweights;

brass, 5 pennyweights; add brass after the others are melted. Another good solder, running a little easier than the above and suitable for work not to be enameled, is: Fine silver, 76½ pennyweights; copper wire, 28½ pennyweights; adding 2 to 3 pennyweights of pure zinc just before pouring. Medium silver solder: Fine silver, 26 pennyweights; copper wire, 15 pennyweights, adding about 15 to 18 grains zinc as above. A very easy solder for repairing is: Fine silver, 40 pennyweights; brass, 20 pennyweights, adding brass after silver is melted. A point to keep in mind is to always use best solder possible. The cost is trivial and the results are much better. All alloys tarnish and blacken as well as the silver itself, but the less zinc used the better will be the quality of the work, and in future repairs it is not so likely to burn out or "rot" in subsequent solderings.

The cost of platinum has caused a number of jewelers to experiment with alloys of platinum and silver, and while as high as 33⅓ per cent of platinum will combine with silver, yet it is not safe or advisable for the average jeweler to attempt to melt more than 20 per cent platinum and 80 per cent silver. The reason of this is that a greater quantity of platinum is exceedingly difficult to melt without running the risk of losing silver by volatilization. An alloy of 80 pennyweights fine silver and 20 pennyweights soft platinum can be melted in the regular furnace by an experienced melter.

Silver lends itself to more finishes than any other of the precious metals, usually showing a much brighter Roman, rose, or green than does gold. For this reason a deposit of silver is sometimes given to a solid gold article as a preliminary to the final gilding. The French jewelers to-day use silver as mountings for diamond paved brooches, sunbursts, animals, birds, etc., backing up the settings with 18-karat gold. These pins as new are very beautiful, the silver taking a mirror-like bright cut in the hands of the skilled stone setter, but in a short time they are tarnished and necessitate frequent visits to the jeweler for cleaning.

Reverting again to silver solders, it is not good policy to make solders out of scrap pieces of sterling or other silver, adding the copper, brass, or zinc, etc., as, while the solder may flow all right, yet it is usually brittle by reason of the sterling silver having probably been melted two or three times, as before mentioned. It pays in the long run to use pure silver in making up all solders. In melting of silver a very little borax may be mixed in.

To test silver, file an obscure part of the article and touch with a solution of one part C. P. nitric acid and two parts water. If silver, a black spot will show; if a low quality (below sterling), the spot will be slightly greenish, but still black. A plated article, when touched with the acid, will bubble up green. A still better test is to add a little red bichromate of potash to the nitric acid, stir well and let stand until next day; then apply a drop to the article to be tested and dip in water; if spot shows red it is silver; on the other hand, should the spot be black or corroded, yellowish, or bright copper, or, in the case of platinum or German silver, which shows no change at all, the metal is not sterling silver. Some experience is necessary in successfully testing silver, and while the average pin or brooch may be quickly tested with a file, yet there are some makes of flat ware in which a white metal is employed that almost defies detection.

The writer noticed, in a recent visit to New York, one or two jewelry stores on the avenue in which the stock was entirely silver. Some delicate and original designs in mountings for semi-precious stones were shown in the form of brooches, pendants, necklaces, bracelets, scarf pins, lorgnette chains, etc. The finishes were mostly on the antique order, shades of oxidizing from light gray to black, green and rose being prominent. It would seem that to the young and ambitious craftsman an opportunity is here afforded to start in for himself in mounting up a few pieces, with the idea of building up a trade in this comparatively inexpensive line. There is undoubtedly an outlet for salable sterling silver jewelry of character and individuality of design.

CHAPTER XVIII.

SOLUTIONS FOR SILVER PLATING.

Some Cheaply and Easily Made Solutions which Give Good Results—Details of Preparation—Making Own Solutions the Only Satisfactory Policy—The Double Cyanide Solution—Use of "Strike" Solutions—Advantage of Solutions without Free Cyanide.

THE following solutions for silver plating can be made cheaply and will give fairly good results: A "dipping" solution, without the use of the electric current, is made by dissolving six or seven pennyweights of silver nitrate in about a gallon of rain water and adding a solution of five ounces C. P. potassium cyanide which has been dissolved in about three quarts of rain or distilled water. Add the cyanide very carefully. At first a white precipitate shows, and upon adding more of the solution this white powder, which is silver chloride, is redissolved. The point to keep in mind is not to add any more of the cyanide solution than just enough to dissolve the silver; a little of the precipitate left on the bottom of the vessel will do no harm. If free cyanide is in the silvering solution it will attack the article to be silvered and combining with the silver in the solution will form a dull, dirty yellowish deposit. If the solution is properly prepared and the article to be immersed thoroughly clean and placed on a clean strip of zinc, a clear white color will show.

A better solution, for use with a cell battery or dynamo, is made by mixing two ounces of C. P. cyanide of potassium in one gallon of rain or distilled water, or water that has been boiled for half an hour and cooled, hanging in a strip of fine silver as an anode, and a smaller strip as the cathode. Remove in about an hour and weigh the anode to find out amount dissolved in solu-

tion, or remove the silver cathode and hang a German silver cathode in place and note the color of deposit. If with a current of one volt there is a very thin coating, remove the German silver and suspend the fine silver again. Should the deposit eventually show yellow or dull it shows that too much silver has been dissolved in the bath, and cyanide must be carefully added until the deposit is white. Nitrate of silver may also be used in making the above solution; in fact, the first solution mentioned can be employed by simply adding a little free cyanide when used in connection with the electric current.

The ambitious plater, however, soon feels impelled to go still further in the line of making his own solutions, and this policy is the only permanently satisfactory one. When you make your own baths, right from the pure silver sheet or granulated metal, you know exactly what you have, and can figure amount of silver in solution, quantity deposited on a given number of articles and what you will need for average daily use.

The best silver plating solution is known as the "double cyanide solution," and is made as follows: Dissolve two ounces of fine silver, preferably plate rolled very thin and cut and twisted in little pieces, in an evaporating dish containing C. P. nitric acid and water—slightly more acid than water. This should be heated on a sand bath, or the dish may be placed in boiling water, the hot water being replenished from time to time. Keep under a draught to carry off the fumes, or place outdoors, as the vapor is poisonous. The silver should be added a little at a time, as too large a quantity at one time may cause violent action and some of the metal boil over. Enough of the acid and water should be mixed to just about dissolve the silver. If, after a time, the silver does not dissolve, even with the heat, add more acid and water carefully. Usually enough to cover all the silver will generally suffice to dissolve it. While an excess of the acid does not necessarily spoil the operation, yet it entails a great deal more labor in subsequently getting rid of same.

When silver is all dissolved, evaporate solution to almost dryness, and upon cooling dissolve the mass, which is now silver nitrate, in a gallon of water. Make a solution by dissolving two ounces of cyanide of potassium in a pint of water, and add to the silver nitrate solution in small quantities; stir well each time, let it stand, and you will note a white powder settling; add a little more until the precipitation ceases. This operation generally extends over a couple of days to be successful. Allow it to stand until quite clear, pour off the liquid and well wash the precipitate several times with water.

Dissolve four ounces of cyanide of potassium in a pint of water and add this to the silver cyanide with brisk stirring until it is just dissolved. Add water to make one gallon. This may be kept in a glass-stoppered bottle and small baths made from it, or the entire gallon may be used. In all cases a little free cyanide must be added to the bath. No definite quantity of free cyanide can be given, as everything depends on the current strength, nature of the work, etc. Suffice it to say, that a little is added at a time until the work shows a clear white. If the anode is left suspended in bath while not in use and shows yellow, it is a sign of not enough cyanide. On the other hand, if there is too much cyanide, the silver is transferred from the anode to the article to be plated and then redissolved in the solution, the coating of silver becoming nothing but a "blush" or film. Too much cyanide will also attack the article, and in the case of a brass or copper piece of goods, your solution will become impregnated with these baser metals, materially affecting the color and quality of the bath.

The great advantage in having a cyanide of silver solution on hand which has no free cyanide is thus readily appreciated from the foregoing. In the case of too much free cyanide in the plating bath the fault is instantly remedied by adding the silver cyanide, and also in replenishing the bath from time to time.

Copper, brass, German silver and white metals should be dipped in a solution of mercury which has been dis-

solved in nitric acid. Get about ten cents' worth of mercury from your chemist, place in a cup or dish and pour over it a little nitric acid; when dissolved, add a gallon of water and stir well. This dip will last a long time. Articles should first be polished or sanded, as the case may be, then thoroughly washed and dipped in a lye solution. Dip in the mercury solution until white, rinse in cold water, and immediately transfer to the silver plating solution. Work may be scratch-brushed with a brass brush, using a little bran water as a lubricant, or burnished, as desired. Best results are obtained by heating solution and using a moderate current.

Iron, steel and zinc should be coppered before plating. A copper cyanide solution is made by boiling carbonate of copper (about ten pennyweights) in a pint of water in which an ounce of cyanide of potassium is dissolved. Use a copper anode, suspend article in, after well scratch-brushing.

Another excellent coppering dip is made by dissolving five ounces of sulphate of copper in one quart of water (cold) and then adding three ounces of sulphuric acid. Stir well; use small copper anode. This last solution is used cold.

Some manufacturers use "strike" solutions for the preliminary coats. This is an old solution of silver, rich in metal. The current is run up and the article suspended for a few moments. A coating of silver is "burnt" on, forming a base for the regular plating bath. Where an extra heavy silver plating solution is desired, as on flat ware, the following is recommended: Fine silver, 5 ounces; cyanide of potassium, 6 ounces; cream of tartar, 3 ounces; prussic acid, 1 ounce; water, 1 gallon.

A bright silver solution is made by dissolving two ounces of fine silver in a gallon of water in which two and one-half ounces of cyanide of potassium and fifteen pennyweights cream of tartar have been dissolved. Now make a solution of one ounce of C. P. bisulphite of carbon and one pint of liquid ammonia; mix in bottle, let stand twenty-four hours, well shake again, and pour one ounce into the above bright silver solution the night before using the bath.

CHAPTER XIX.

BLACK AND GRAY FINISHES ON SILVER.

Liver of Sulphur Solution the Standard—Process of Oxidizing—Methods of Securing the French Gray Finish—Relieving the High Lights—Touching up Parts—Platinum Solution for Intense Black Finish—Solution for Use with the Dynamo—A Black Nickel Solution.

TO produce the dark bluish black finish, the "French gray" and "Butler" finishes, etc., on silver, or heavily silver plated goods, liver of sulphur is as good as any of the formulas in use. Some firms prefer it in a liquid form under the term sulphide of ammonia. Where it is not in daily use it should be purchased in small lots; ten cents' worth of liver of sulphur (in lumps) kept in a well-stoppered bottle will oxidize a great deal of work. Silver goods to be oxidized should, after scratch-brushing with a steel brush and bran water, be immersed in a caustic solution, either soda, lye or potash, rinsed, and immediately dipped in the liver of sulphur solution. This last should be made fresh as needed; a piece the size of a small marble will be enough for a two-quart pan of water. Have your work strung on a copper or brass dipping rod. Heat the water nearly to a boil, then throw in the liver of sulphur and bring to a boil, when the sulphur will have been dissolved; then immerse the work and it will almost instantly become a deep blue-black. Keep the pan covered as much as possible. An ordinary enamel lined stew pan with a good handle and lid is all that is needed. Some finishers add a few drops of ammonia just before putting in the work. If work is left in too long a deposit is formed on the articles, which scales off. In this case, or if an even black is not obtained the first time, rinse off, re-scratch-brush and dip again. As soon as work shows black re-

move, rinse off, first in cold water, then in hot, and dry at once in hot sawdust. The pieces after well drying are scratch-brushed with a very fine brass brush on a slow lathe. This brings out a glossy blue-black finish. Another way is to rub with a piece of flannel, slightly oiled.

The French gray finish is secured by rubbing with pumice powder and water, using a small brush, or a piece of cloth pad, or your finger. In this case work is not dried out in sawdust; simply rinse off after removing from the oxidizing solution and immediately apply the pumice powder. When the desired tone or shade is reached, which is ascertained by rinsing off occasionally as you use the pumice, the work is finally well rinsed and dried in sawdust.

Another excellent method in getting the delicate gray is to carefully sand the work. This necessitates drying out in sawdust first. After sanding the dark spots out, finish by rubbing the high parts with the pumice powder. Some customers like to have parts brightened or burnished. This is easily done with a bloodstone or well-polished steel burnisher, sometimes finishing off with the rouge buff. For certain repair and small jobs, a glass brush will answer for relieving the "high lights." This last has a tendency to give the silver a slightly yellowish tinge and is not as good, consequently, as the pumice-stone powder. This, by the way, should be the very finest grade of powder. There are several grades of coarseness. For touching up parts, a little bottle of water with a small bit of liver of sulphur kept on your bench comes in very handy. In this case warm up the work over an alcohol lamp and paint on with a clean camel's-hair brush. When solution gets weak, throw away and make new.

Some platers recommend dipping work in a weak solution of bichloride of mercury and sal ammoniac before oxidizing, others give work a dip in the silver plating solution, thus depositing a film of fine silver. The writer has found these of no particular benefit and

has found that if work is thoroughly clean, well scratch-brushed with the steel brush, and is sterling silver, or of a silver alloy in which copper is the principal metal used in alloying, the resultant finish is just as good with the plain liver of sulphur solution. Other formulas, if the reader feels like experimenting, for getting a dark shade, are sulphide of barium and water, also butter of antimony. Use very little of these to plenty of water.

Another "French gray," used by a large silver concern, is a solution of 3 parts nitric acid to 1 part of muriatic; or, Sulphate of iron, 1 ounce; muriatic acid, 2 parts, and nitric acid 1 part, using just enough of the acids to dissolve; evaporate to one-fifth its volume, cool and add one-third its volume of alcohol.

The intense black finish is secured only with the chloride of platinum solution. This is obtained, as explained in a preceding chapter, either by purchase or making your own chloride by dissolving sheet platinum (pure), rolled very thin and well crinkled to let the acids attack it readily, placing in a long-necked flask, pouring on a mixture of three or four parts of chemically pure muriatic acid to one of nitric acid. Enough should be poured on to cover the platinum. Place in a hot sand bath, letting it remain until dissolved. This sometimes takes fifteen or twenty hours. Let dry until almost cool; add a little distilled water and evaporate again; let it cool and carefully add about two ounces of pure grain alcohol for each pennyweight of platinum used. A good plan is to have three glass-stoppered bottles containing various strengths, starting with the weakest solution, which is diluted with half water, and finishing with the strongest solution, which is about one-fourth chloride and three-fourths alcohol. A little experience will teach you how much water and alcohol may be added. A pennyweight of platinum will last an indefinite time and will make about a half-pint mixture.

The piece of silver, or the article well silver plated and thoroughly cleansed from all grease, is slightly warmed and brushed with a rather stiff brush dipped in the

weaker solution and finally given a coating from the strong or first solution. Small articles are warmed over an alcohol lamp, taking care to keep the bottled solutions away from the flame. After a deep black shows the work is let cool and finished with a soft brush or cloth, slightly oiled with a little pure oil. A glossy black is secured by using a solution in which a little gum arabic has been dissolved, avoiding an excess of the gum, as it dries "cakey" and scales off. As a rule, the article will be glossy enough for all requirements if carefully finished with the oil.

In work that has been silver plated it is well to be as expeditious as possible, as the solution is liable to eat the plating off, exposing the metal underneath. A little experience will soon enable the workman to get good results. These platinum solutions will keep for years in glass-stoppered bottles, and are always available for repairs, retouching, etc., and in jobs where it is not worth while to make an iron solution the work may be quickly given a heavy silver deposit (if not solid silver) and blackened with the platinum solution in a few moments, insuring a beautiful black that is lasting.

This platinum oxidize finish is largely used on gold work to-day, people in mourning bringing in their jewelry to have it silver plated and blackened, also buying new goods to be refinished black. The period of mourning over, the jewelry is restored to its original color at slight expense. This platinum solution properly applied gives fully as rich a velvety black as the iron gun metal finish, is quite durable, and does not become pitted or show rust spots, as in the case of the iron deposit. Chloride of platinum may be purchased already prepared for mixing with alcohol, from the chemical supply houses or wholesale druggists. Work after being well blackened is carefully brushed with a slightly oily brush or rubbed with a cloth. A little chloride of iron may be added to get a little less expensive solution. It is advisable, however, to keep the platinum in the larger proportion.

Here is another recipe for a black finish in which a well regulated dynamo must be used: Water, 1 gallon; acetate copper crystals, 3½ ounces; carbonate of soda, 3½ ounces; bisulphite of soda, 3 ounces; C. P. cyanide of potassium, 7½ ounces. Moisten the copper salt first to make a paste; next stir in the carbonate of soda, then the bisulphite of soda, and finally the cyanide. The solution must be colorless; if not, carefully add more cyanide. The article is plated in this solution, using copper sheet anode and a current of about 1 volt for small stuff. When a good copper deposit has been obtained remove the article and immerse it in a solution of 2 ounces nitrate of iron and 2 ounces of hyposulphite of soda to 1 pint of water (rain or distilled). Warm it up, not exactly boiling, wash, dry and brush. The better the article is polished, the deeper will be the black lustre.

There are various black nickel solutions on the market; the following is good: Nickel solution, 1 gallon; carbonate of ammonia, 3 ounces; liquid 20 per cent ammonia, one pint; white arsenic (powdered), 1 ounce; and enough cyanide of potassium to make solution clear. Pulverize the carbonate of ammonia and add it to the nickel solution. Next add the liquid ammonia. Now dissolve the arsenic in a small quantity of the solution (make it into a paste) and add, the cyanide of potassium being added last, using just enough to clear; it should be about the color of dark vinegar. Use a nickel anode, with not too strong a current. If the work shows streaks or spots, remove and scratch-brush, then use a stronger current. Too much current will show a dirty gray-black. After the solution has been used for some time the deposit may be off color. In such case add a little more arsenic.

CHAPTER XX.

GUN METAL FINISH.

An Iron Coating That Stands the File Test—Directions for Dipping—Process and Formula for Gun Metal Finish—Cheap Enough to Experiment with—Always a Demand for This Finish—Use Fresh Solutions.

TO get a coating of iron that will stand the file test the following solution is given: Sulphate of iron, 12 pennyweights; dissolve in 15 liquid ounces of water; add 6 ounces of 20 per cent ammonia, stir well, and then add one and one-half ounces of Rochelle salts. Use hot. Have good, clean current connections and plenty of sheet iron anodes. Current should be regulated to amount of work, but need not be over three volts. Work is well sanded, scratch-brushed with steel brushes and dipped in a weak, hot solution of caustic soda in water, before immersing in bath. Take out frequently and well scratch-brush until an even deposit is obtained, when work may be left in from fifteen to thirty minutes. On the first dip the work will show a rich black; this, however, is but a film, and will brush off to a lighter shade. Be sure that the entire article is coating evenly before giving the heavy deposit. If directions are properly followed, a grayish white (like dull silver) deposit of pure iron will be the result, about the thickness of the paper this is printed on. If a thicker coating is desired, the article may be left in longer, scratch-brushing at intervals; the thickness of deposit is ascertained by taking a fine needle file and applying it to the article. If the work does not appear to be "taking," run up the current a little; as high as six volts may be used, but where work is enameled, the lowest possible current must be used.

To get the deep blue-black or gun metal finish, the work is rinsed off in hot water after the final scratch-

brushing and hung by a copper wire in a porcelain or enameled pan containing a solution of 12 pennyweights acetate of lead and 12 pennyweights of hydrosulphite of soda, each of these ingredients having been previously dissolved in a half-pint of water, then poured together and warmed. After the work is immersed, bring to a boil, remove, scratch-brush, and repeat once or twice, when it will present a bluish appearance; wipe dry, and if hollow, hold over an alcohol lamp to dry out; now take an oiled brush or cloth and brush or wipe carefully, avoiding an excess of oil—just a smear is all that is wanted—using boiled linseed oil. Wipe or brush almost dry and hold over an alcohol lamp; watch carefully until a deep, velvety black shows, when let cool and hang in linseed oil until wanted. Work in quantity is "baked" in iron ovens made for this purpose, and of course can be better regulated as to temperature, etc.

It will require experience and patience to get through the various operations successfully, and the beginner should practice on some metal pins before attempting to take up the work in hand. For all small work, as brooches and handy pins, the alcohol lamp may be used, but in lorgnettes, hand bags, cigar cases, etc., the oven is necessary. The work as it comes from the acetate of lead bath is almost deep enough in shade, and only needs the additional heating to give it the desired gun-metal color. Any size bath, of course, may be made by simply keeping the same proportions; being an inexpensive solution the amateur may experiment to his heart's content, and by regulating the heat, get shades from a deep blue-black to an intense velvety black. Sometimes the acetate of lead and the hydrosulphite of soda may be old stuff, in which case use a little larger quantity.

There is always a demand for jewelry with the genuine gun metal finish, and of late years black enamel pieces, chains, or brooches, showing absolutely no gold at all, are constantly being called for. In the case of the chain, it being impossible to enamel the small connecting links, the gun metal solution is used after chain is enameled

and soldered together and an all-black effect for deep mourning is obtained. In this way many articles received from private customers may be given the black finish during a period of mourning, the black being removed at a trifling expense and the piece of jewelry restored to its original state when desired. To remove the iron deposit, boil in a solution of nine parts water and one part sulphuric acid, of course first removing all pearls and all semi-precious stones, corals, amethysts, topaz, etc.

Iron solutions generally work best the day after they are made. They will keep in glass-stoppered bottles, but should not be kept too long; better make fresh solutions often.

CHAPTER XXI.

SILVER AS A BASE FOR BLACK ENAMEL.

A Demand for Sterling Silver Jewelry—Cost of the Metal is Small Compared with That of Gold—Black Enameling Presents Field for Great Opportunity—Method of Getting a Satiny, Frosted Effect—Use Care in Handling Acids—Process of Annealing.

A LARGE number of manufacturers of fine gold jewelry, recognized as such throughout the trade, find it a paying proposition to also make sterling silver jewelry. The chief reasons for so doing are, first, that there is a demand for it; second, the cost of making the dies that are used for the gold work, and which are used in the silver goods, is overcome in the increased output, and third, it affords employment to a number of employees who would possibly be idle during the dull seasons in the gold line. The third reason is not wholly philanthropic, as lack of employment causes disorganization, workmen seek other positions, and when the orders come in and the rush season is on it is not an easy matter to get suitable artisans skilled in the work to making the producing end run evenly, as formerly.

Sterling silver costs about six cents a pennyweight at this time, 10-karat gold forty-six cents, and 14-karat gold sixty-five cents. It is readily seen that the cost of the metal is comparatively nothing as compared with gold, and as silver goods are usually made in large quantities the labor is consequently less. Now, silver is a precious metal, is solid all the way through, and is demanded by customers who will not wear the rolled plate gold jewelry, and in the shape of summer jewelry, class pins, buckles, cuff links and buttons, especially where the design is unusual and the die work superfine, the sale is rapid, and orders are duplicated.

Some houses make a die and use it exclusively on gold the first season, thereafter working in both gold and silver. Odd designs or novelties will sell better in silver than gold, the customer getting a solid article cheap and also knowing that the changing fashions will make the piece of jewelry look out of date the following season and the low cost will enable the purchaser to buy the latest design.

As noted in a previous chapter, silver will admit of infinite finishes, colors, shades, etc., but the writer does not propose to speak of these here except the making of sterling silver jewelry for black enameling. This is a field for great opportunity if the goods are finished properly. It is, of course, obvious that there is a demand for mourning goods and always will be. The average person is unable or may not care to purchase solid gold black enamel pins, buttons, cuff links, bracelets, or chains, and therefore looks for an inexpensive substitute that is not plated, brass, etc. Silver is the only logical metal, and is thoroughly practical for all kinds of enameling. Black enamel work is most durable and lasting, keeps its intense black, and in comparison with the gun metal or the various oxidized finishes stands easily away in the lead.

The art of enameling is perhaps not as difficult as it may seem. To those who are finding some difficulty in getting good results the writer gives the following tips: Have a depth cut of about forty points, dial screw gauge, with the stop line at right angles, cut straight and sharp. All work should be thoroughly clean and annealed before charging. Always use the hardest running enamel your work will stand. In black enamel work the piece should be dipped in hydrofluoric acid and brushed with sand and water before the last coat of enamel is put on. This is done to remove scum in the enamel, which might show in the subsequent frosting or etching. On flat work the enamel is usually put on thick, then filed with carborundum, or emery files and water, then lapped on a felt buff which is charged with pumicestone and water. This lev-

els the enamel to the stop lines, making the surface of the article smooth and even. It should be said that work is fired after the filing and before lapping on the felt buff.

There is a demand for well-made and finished black enamel jewelry, and to get the best results the work is etched or crêped in two solutions. Solution No. 1 is made of hydrofluoric acid well broken by adding three to six ounces carbonate of ammonia, small pieces at a time, until work after immersion for about one minute shows a dull, grayish, even black. If acid is too strong the work is pitted or is uneven, dull here, bright there; it must be absolutely uniform before the final dip in solution No. 2. This solution is the same as No. 1, except that about one-half the carbonate of ammonia is added. Work should be dipped in this only for an instant, then immediately plunged into clean, cold water and brushed with a stiff tampico brush. It is well to have two bowls, papier maché or rubber, as all glass or porcelain is dissolved by the acid. Work for dipping is placed on little disks of brass well perforated, and connected to a long handle of brass or copper. Get your plumber to make you a few lead cups, with covers, for holding the acid.

Work as it is taken from No. 1 solution shows a grayish scum. After plunging in first bowl of water and then rinsing off in the other after brushing, the work is wiped with clean cloth and if not found to be evenly etched is again immersed. Be sure that work is right before giving the final dip in No. 2. The beautiful soft velvety black finish is gotten this way, and by experimenting with different strengths of acids the dull black, velvety black, also the bright satin-like lustre, is acquired. The writer has seen work that is spoiled by using a white acid, which gives work a gray finish and a cheap look. In ordering enamel always state quality of your goods, gold, silver, or metal, and state also whether for polished enamel or for etching.

Great care must be exercised in handling hydrofluoric acid, as it is very powerful and a drop on the flesh leaves a very painful wound; should any get on, plunge at once

into clean, cold water from faucet. It is best kept in 10-pound lead jugs. The carbonate of ammonia should be kept air tight. Acids once broken down and working right may be kept for some time in the lead cups well covered.

All work, after final dipping, which is known to be all right by drying one or two pieces, is placed in a clean dish and kept under water until it is convenient to wash it out well in warm water with soap and a little ammonia and drying in best boxwood sawdust. A point to keep in mind is that work must be kept under water after once having been dipped in acid and until after the final washing and drying in sawdust.

Some houses have gone after the black enamel line and make a specialty of it, advertising themselves as such. The above formula is used by the best firm in the business to-day, making 14-karat and 18-karat goods for the best stores in this country and also for the Paris store of one of the largest houses here. This manufacturer has also made a great quantity of sterling silver, but of late years has been forced to discontinue this, owing to the increased demand for the gold goods, not having the capacity and facilities, also possibly not caring to handle both.

Sterling silver black enamel work is usually gilded either Roman or 14-karat finish, which wears well and survives a period of mourning.

While it is advisable to have a regular enamel annealing furnace, yet good work can be done in a coal stove. Use good live fire, all the gas burned off, and place work in on a sheet-iron stand which rests on a fire clay disc or plate as a foundation. Watch carefully and do not overheat so that pin is unsoldered or melted. Black enamel work, if well dulled, presents a beautiful velvety finish, looking very much like onyx jewelry, only richer and more even in shade. A bright, dull, or "greasy" finish is acquired by giving it a lightning dip in a still stronger solution, *i. e.*, less carbonate of ammonia in the hydrofluoric acid. At all events, avoid the dull, dirty gray so

commonly seen on the cheaper grades of jewelry. It does not cost any more to get it right after you have once gotten the hang of it.

No matter what the final tone is to be, all black enamel work is given the preliminary dulling in the first solution, which must be very weak. If it is not so, your work will come out pitted, streaky, with bright spots here and there, all caused by too strong a solution. The second acid brings up the rich black in its various tones, shading from dull to a brighter, satiny frosting. Do not use white acids for crêping, nor any ready prepared frosting solutions. It is best to get a 10-pound jug (lead) of hydrofluoric acid and a can of carbonate of ammonia and break it down yourself, so you will know where you are at.

Bear in mind that the enamel in the solutions is etching, or eating away, thereby thinning the coating and running the chances of showing through to the metal. Experiment with old discarded goods until you get the acids "right," and then proceed as rapidly as possible. In buying enamel, always state whether you want it for bright or dull finish, and also tell what metal you are going to use it on.

In raising sterling silver work for enameling, the writer finds that the best results are obtained if from ten to twenty points, dial screw gauge, thicker stock is used than that of gold, or, in other words, from one-quarter to one-half as thick again as the gold work. This extra thickness on the part of the silver is necessary to overcome the softness of that metal and the consequent bending and chipping of the enamel. In comparing black enamel gold work with that of silver the enamel shows exactly the same, and in the case of, say, a pair of silver link buttons, the metal will cost about twenty cents and will look exactly the same as a pair of solid gold links, with the metal costing anywhere from $3 up. The silver links will wear as well and give the same satisfaction and answer the purpose.

CHAPTER XXII.

ENAMELING.

Avoid Dust in Enameling Room—Preparation of Enamels—Charging and Firing—Modeled and Painted Work—How to Remove Enamel—Fluxing—Firing on Ornaments—Very Close Inspection is Necessary—Engine Turning vs. Hand Engraving.

WHERE possible, enameling should be done in a room removed from the machinery, belts, etc., the floor should be sprinkled to keep dust particles down and finer grades of work should always be kept under glass covers while in process of charging or painting. Have the furnace in a dark or well-screened corner, so that work may be more carefully fired. For the lower priced enamel jewelry and metal goods, enamel machine grinders or crushers are used, as also when a large quantity of enamel of one color is to be prepared, but in the finest and most expensive jewelry the enamel is crushed by hand, using a steel pounder that fits snugly into a steel block so that enamel will not be lost in the breaking and pounding. When well pulverized the powder is removed, well rubbed and washed out with several washings in an agate mortar, using distilled water that has been filtered through best filtering paper into a glass-stoppered bottle. In fine work it is absolutely essential that the enamel be well ground and thoroughly washed to remove all grit, scum, etc. Now put into enamel cups ready for charging; keep moist and cover article evenly with first coat, using round steel chargers ⅛ inch thick, flattened out on the ends. Keep a number of small pieces of clean white blotting paper handy for use in taking up excess of moisture in enamel; by pressing around the edges of pin the water is drawn into the blotting paper. Work should not be allowed to stand too

long before firing, as enamel will dry and fall off. It is advisable to have sheet-iron forms that work fits into, as in the annealing soldered parts may be loosened or strained.

In opaque enamel work, inlaid, see that edge or stop line is sharp and at right angles, especially in white enamel, as white requires more care in avoiding burnt or yellow edges. About the right depth of cutting for enamel is 40 points on the dial screw gauge. Carborundum files are used for filing enamel flat to gold edge, keeping them wet in water. The work is then given a final firing and the face of pin is lapped on a felt lap charged with pumice powder and water. This operation removes waves, blemishes, etc., and gives a mirror-like finish to work. Work that is modeled, as flowers, etc., of course cannot be lapped, so greater care must be exercised in the charging of the enamel so that the shape of flower is kept and the enamel spread evenly.

All work for painting, tinting, veining, etc., is first given an opaque white enamel ground, using as hard a white as quality of goods will stand. Use liquid paints furnished in tubes by first-class enamel paint supply houses, as they are better than the powders. Paint should be well rubbed up with oil of lavender. As a rule work burns a little darker in repeated firing, so it is well to keep it a shade lighter than the sample to be matched.

Black, or almost any opaque enamel work, is usually done in about three chargings and firings; in the case of the black, the work must be dipped in a weak solution of acid, to remove any possible scum, and well brushed with sand and water before the final charging and firing.

In preparing enamel it is well not to pound up more than enough for the day's work, as the moist mixture "sours," to a certain extent, over night.

Enamel may be removed from work by letting stay in hydrofluoric acid over night, or in case of need it is boiled off in a copper pan over a gas burner placed in the forge or where there is a good draft to carry off the fumes. Where work is done on a large scale, a suction hood,

with forced draft from a blower, should be installed, as the fumes and vapors are poisonous and will "frost" all the windows, spoiling spectacles, etc., costing at the end of a year many times over the cost of a hood with pipe from blower. Enamel may also be removed by covering the enamel thickly with a paste of cyanide of potassium and water; anneal and boil out in the regular sulphuric acid pickle; when all effervescence ceases the enamel will have disappeared.

All the regular colors of enamel, as black, white, turquoise, green, red, etc., require no fluxing for either bright finish or for etching; but work that has been painted or shaded is usually given a light coating of flux to protect the painting, as in the subsequent etching the paint, or some of it, would be attacked. In some flower work, however, where the painting is of one shade, with no veins, a much more delicate result is obtained by using a slightly darker shade of paint and not fluxing. In the etching the paint is, as said before, attacked, and upon removing and washing out a lighter shade is the result; the edges of flowers are thinner and more natural, as the flux, which is a transparent enamel, makes edges thick and the whole effect clumsier.

Some enamel jewelry, as belt pins, handy pins, etc., are embellished with little gold stars, dots, etc., scattered at intervals over the pin. These little ornaments are punched out of fine gold rolled as thin as tissue paper. The punches are filed up to the desired shape and fired on in the last firing.

In pins, where only sections are enameled, much better colors are secured by using a fine gold background; take, for instance, a brooch having a small red enamel star or other ornament; if a piece of fine gold be fitted in, the red enamel is richer in color. In cases of transparent blue and amethyst a background of fine silver is used, always keeping in mind the fact that all transparent enamel is brighter and richer if work is put through stripping solution to remove fire stain and the background is rouged before enameling. All work should be examined and all

edges, burrs, etc., well scraped and rounded so that pin will not show transparent in spots after enameling and etching.

Work that has settings soldered on to be flush with the enamel, and, in fact, anything that is to be enameled up against the solder line, should be carefully scrutinized for pin holes, unsound soldering, etc., as all these imperfections will cause more trouble in the subsequent setting of the stones and finishing.

In work for transparent enameling showing an undercut pattern of engine turning, some very fine effects are shown by using these machines. Some very pretty patterns can also be cut by hand, and on certain work the cost is not any more. Take a bar pin, say two inches long and one-quarter inch wide: an engraver can cut a spray of leaves, using a lining tool to make the background, which, when enameled, has an artistic effect and sells well.

Unless one is going into enameling strongly and on a large scale, the purchasing of circular, straight line and oval engine turning lathes, with a large variety of patterns, rosettes, etc., is a rather expensive proposition, especially as styles are fickle and change rapidly.

Where it is practical, work for enameling should always be made out of newly alloyed gold, always remembering that an alloy with as few ingredients as possible is best, and the least number of meltings and annealings will result in less oxides.

CHAPTER XXIII.

ENAMELING (CONTINUED).

Variety of Design and Economy of Production a Feature of Enamel Work—It Also "Looks the Money"—Quality of Gold to Use—Engine-Turned Goods—Specializing the Work—Flux for Use over Painting—To Get Black Lines.

THE old saw about "the jeweler's work being poor and tame without the engraver's cunning art," may be applied with equal truth to the enameling of jewelry. In the ceaseless striving for new effects at salable prices enamel work is most kept in mind. There are two excellent reasons for this, the first being the infinite variety of styles and designs one may get with the use of enamels, and the second is the cost. A large and very showy piece of jewelry, looking every cent the money, can be produced at comparatively moderate cost by the judicious use of enamel parts. Take, as an instance, a finely enameled iris, with a platinum stem or twig set with a few diamonds, or a large pansy, the edge of which is set with small stones, or fancy scroll, or lacework pin where the enamel is artistically worked in with the precious stones.

In the making of these pins it is obvious that the slight additional cost of using high quality gold more than offsets the frequent chipping of the enamel (or at least the likelihood of it) that usually results in the using of gold that is of low quality and perhaps has been melted over several times. At the same time there is a danger of making gold too fine and consequently too soft for practical purposes. As an instance, one large manufacturer made recently a lot of 22-karat goods, making them extra heavy and massive. He succeeded in placing them in the fine stores on Fifth avenue, New York, but they did

not sell and were sent back to be credited off, and went to the melting pot. The goods were too heavy, the softness making it necessary, and also too high priced; in other words, they did not look the money. While on this subject, it is noteworthy that shoppers pass up, as a rule, anything over 14-karat in this country, but seem to buy and favor the purchasing of 18-karat and better in the European countries.

Every maker of fine enamel jewelry has his pet alloys and uses anywhere from 14-karat up. An 18-karat alloy of 18 parts fine gold, 4 of silver, and 2 of copper is a good one to work on. If a lower quality is desired, simply take from the gold and add to the silver and copper so that 17-karat would be, fine gold, 17 parts, silver, 4½ parts, and copper, 2½ parts. Softer alloys may be made by using more silver and less copper. It is not advisable to use less than the quantity of copper given, however, as the alloy being soft, it is liable to bend and chip the enamel.

The beautifully enameled watches and lockets exhibited in the stores were, in the first instance, imported, some of the jewelers here manufacturing them later. These goods were all made in 18-karat and showed some fine engine turning combined with a little hand cutting, and were sold for a little less than they could be made for in this country, in spite of the high import duty. The writer saw some silver bonbon boxes from Germany selling for $6 apiece that could hardly be engine turned alone for that money, to say nothing of the cost of enameling in varied and many colors, the making of the box, etc. The reason is that goods are made of one pattern in enormous quantities, also the cost of labor being about one-quarter that of this country.

It is quite possible, however, to so specialize your work that you can compete. One Newark firm has made a success and created a big business by devoting all their attention, time and money to engine-turned goods. One of the members went directly to Switzerland, the headquarters of engine-turning lathes, and got all the latest

information, newest "rosettes," or patterns, and other wrinkles. As a consequence, others simply have to go to this house for a fine job or to match a piece of foreign jewelry. The point is that you can't nibble at everything; you may have an established trade with a few old concerns, but the young blood coming along is forced, as a matter of self-preservation, to keep thoroughly posted on the newest and most up-to-date novelties, so the specialist is bound to get in because he will have better goods at lower prices.

There are two lathes necessary, the circular, to which may also be fitted an oval chuck, and the straight line. These lathes come from Switzerland and are fitted with numbers of pattern or "rosette" wheels, which, by means of set screws and other attachments, levers, etc., will admit of an almost endless variety of designs. They may be purchased for about $200 to $250. They are fitted so that the work may be directly turned.

There are also engine-turning lathes for dies. These are built on stronger lines with powerful holders for the die. To the maker of work in quantity the die lathes are the proper thing, although the cost of them is about $500. The die once made, however, there is no extra cost over that of any other die-raised article. Some firms have their die cutting done outside; a firm in New York makes a specialty of engine-turned dies for the trade.

All work for transparent enamel should be first put through the stripping solution and rouge buffed. This insures a bright background for the enamel and presents a much livelier and richer finish. It is not customary to stamp the gold, other than 14-karat, for the reason that the joint, catch and pin tongue are usually of that quality, and if stiffening parts are used they may also be of the same grade. In other words, only the part that is to be enameled need to be of better quality. In the opaque straight colors, as red, blue, turquoise, black, white, etc., a 14-karat alloy of fine gold 14 parts, to 7 of silver and 3 of copper, will stand up well, and it is not necessary to use any better quality.

It is apparently impossible to get a pink enamel that will stay pink in the firings and not get a yellowish brown on the edges. A number of makers of enamel have a so-called pink which might possibly do for low-priced or plated jewelry, but the finest pink enamel work to-day is painted. This is done by first coating the pin with white enamel and painting on the pink, using shades of fusible lilac purchased in tubes. Some stores prefer a very delicate pink and others demand a more solid color. It is essential to use the very hardest running white enamel that the goods will stand.

In ordering enamel always state what you are going to use it on. The tool and material supply houses have a stock of enamel which is mostly easy running for repair work. Enamel jewelry after painting and firing will last longer if a final coat of flux be fired on. This flux is nothing more than the best transparent glass well ground. One house the writer was with bought quantities of druggist's small pellet bottles and ground them up as a flux.

The beautiful frosted or etched effect may be given to enamel by quickly immersing in a solution of hydrofluoric acid and carbonate of ammonia. The ammonia is simply put in to somewhat lessen the strength. Holding over the mouth of the acid jug will oftentimes suffice. The crêping of black and other opaque enamel work was taken up in a preceding chapter; greater care must be exercised in the mixing of the acids and in the dipping and finishing. Hydrofluoric acid should be kept only in lead or rubber jugs; avoid inhaling the fumes and always keep a large dish of clear, cold water handy in case you should accidentally get any of the acid on you.

A very good black is secured on jewelry where it is desirable to keep the veins, lines, etc., prominent in the case of a face, which would be filled up to a certain extent with enamel, by simply painting with iridium black (fusible) and firing. Some fine work has been done in this way, notably Moors' heads, with a large baroque pearl as the head ornament or fez.

CHAPTER XXIV.

MELTING PLATINUM.

Cost of Melting and Tedious Wait Offsets Expense of Installing Oxy-Hydrogen Furnace—Details of Operation—Close Attention Needed—Platinum Faced Nickel in Sheet and Wire—Recovering the Platinum from Plated Stock.

JEWELERS using platinum daily and in fair quantity are gradually installing platinum melting furnaces. The charge for melting scrap is in the neighborhood of $1.50 per ounce where it is taken in exchange, and this, coupled with the time it takes to get new platinum, more than offsets the cost of the oxygen and hydrogen tanks, these being the only running expense. The furnace is capable of holding a crucible having a capacity of about 100 pennyweights, and is a round, table-like affair of iron. The crucibles are specially made for melting platinum, and are thicker than the ones used for gold or silver. The two tanks, one containing oxygen and the other hydrogen, are purchased from the New York Calcium Light Company. A meter is also sent, with a wrench for turning on or off the gases and for regulating the pressure. These tanks, when found to be nearly empty, are replaced by other freshly filled ones.

Now the melting of platinum scrap, whether pure, or alloyed with 10 per cent or 20 per cent iridium, is not as difficult as it perhaps would seem, and if the following directions are carefully followed, any one who has done any melting of gold or silver will soon get onto the knack. The scrap is first rolled thin, say about 40 points in the dial screw gauge, cut in small pieces about one-quarter inch square; place a few pieces only in the crucible and start the gas furnace. The gas and air are supplied by means of the ordinary rubber tubing, or, if one desires,

a pipe can be attached; regulate your furnace as in other melting and prepare your tubing for the tanks. A tube is connected with each tank, combining and feeding one nozzle. This nozzle is also supplied by the material houses which sell the furnaces, and is a specially made mouth of about the same stuff as the crucibles.

As soon as the crucible is thoroughly red hot, or when it is noticed that it will not get any hotter, take the nozzle in your left hand, using some sort of asbestos shield in front for protection, and ignite the hydrogen first by turning the nut at the top of the tank. Regulate until you have a flame about the length of a lead pencil. Now turn on your oxygen in the same manner. Turn very slowly and watch flame until it gets more intense in volume and finally "spits." Take off the cover of the furnace and insert mouth of the blowpipe. Keep about an inch from the platinum, which should get white hot and melt almost immediately. Watch closely, using a large pair of black goggles, and keep your hand and wrench on the oxygen tank. When melted into a button, have a careful assistant add more scrap, a little at a time, using an iron tube or scoop. If too much is put in at once there is danger of having trouble in melting.

In the process it sometimes happens that one of the gases may go out; perhaps the tubing may get bent or the pressures are not just right. In this case quickly turn off the oxygen and then the hydrogen and start over again. A little experience will teach you how to avoid this. The moment the flame is removed the platinum hardens, and with thirty or forty pennyweights in the crucible in a lump, it is difficult to get it melted again. The point to watch out for is to get the combination of the two gases just right before starting to melt. As said before, if flame "spits" the metal will melt at once. When all scrap is melted, turn off the oxygen, then the hydrogen, and finally the gas. The crucible is lifted out and turned over; a sharp rap will loosen the button, which is then cooled and worked up into plate or wire, as desired. In this way the manufacturer can melt his own scrap several

times during the day if he desires. The tanks cost about $6, and with care last for a great many meltings.*

With platinum containing 20 per cent iridium soaring around the $175 per ounce mark, and pure platinum only a few dollars less, there is a great deal of experimenting being done by refiners of this metal. One firm is making a platinum-faced nickel sheet and a platinum-clad wire, both of which are finding a ready market. The proportions of platinum and nickel are varied to suit the buyer's requirements. Pure nickel is sweated to the platinum, no solders being used. The wire is a seamless ingot, hollow, of platinum, into which is inserted the nickel. This metal will work up into almost any shape and the wire may be drawn to any thickness or rolled flat and worked into knife-edge wire without exposing the nickel centre.

Ordinarily the platinum-faced sheet is 25 per cent platinum, costing about $80 per ounce, and the wire 30 per cent platinum, at about $85 an ounce. The specific gravity of pure platinum being 21.6, with the above sheet 10.4 and the wire 10.8, you get about twice the number of square inches per ounce of wire and slightly more in sheet. Users of this plated stock can exchange the clean scrap for new plate at a reasonable cost per ounce. If the jeweler so desires he can recover the platinum by putting in nitric acid, which eats off the nickel. Should the acid not seem to be working,—if no action, bubbling or effervescence soon shows,—carefully add muriatic acid. In this case do not add more than is necessary to start dissolving, as you have now made aqua regia, and in the proportion of about 3 parts muriatic to 1 part nitric, it will attack the platinum itself. There is practically no danger of this happening, however, until all of the nickel has first been dissolved. Use chemically pure acids. In the matter of platinum filings do not attempt anything with them. You will be better off by sending to the refiner.

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*Since publishing the first edition of "How to Make Jewelry," a specially made platinum melting furnace has been put on the market by the Jewelers Technical Advice Co., of New York.

It has been found that 20 per cent of iridium is about the maximum quantity that may be melted with pure platinum to give it hardness. More than this makes the metal too brittle, scaly, and extremely difficult to work, roll or draw into wire, etc. In ordering it is advisable to get it as near the size you want it for as possible, especially in the case of the wire. This extra hard platinum is used in snap pieces, stiffening or brace parts, eyes for eyeglasses and spectacles. A 15 per cent or 10 per cent iridium platinum is also used for various purposes. The pure platinum should always be used in raising hollow work, or, in fact, any die work, and particularly for the setting of stones. The iridium, while it alloys with the platinum, seems to do so very much against its will, and a brittle or scaly spot will often show up, which in settings would be costly.

Another point to be taken note of is that in returning platinum scrap for credit or exchange the refiner takes it as pure platinum, so that the difference between that and the iridium sheet, 10 per cent, 15 per cent, or 20 per cent, as the case may be, is a loss. With your own melting apparatus it is a good idea to put all your iridium scraps into wire, reserving the pure platinum for sheet.

There are three platinum solders in use to-day, a hard, a medium, and an easy running solder. The first two are used in pure platinum or platinum and iridium, the last, or easy solder, for repairing or soldering on extra finishing parts and for the nickel-backed platinum. In using the others there is danger of melting the nickel, or of at least burning it or warping the article.

CHAPTER XXV.

WORKING IN PLATINUM.

Formerly Used as Diamond Setting, Demand is Growing for All-Platinum Jewelry—Soldering Gold and Platinum—Alloys for Hardening—Transferring Designs—Scroll and Mesh Work, Carving and Modeling—Lining Modeled Work—Plating with Platinum.

PLATINUM when first used in the jewelry shops was employed only as a mounting or setting for diamonds, as the color of the metal, being a pale shade of blue, harmonized well with the stone. A piece of platinum jewelry was stiffened by the addition of a backing, usually of 18-karat gold; gold of lower quality (while sometimes used) is too hard and shows a seam that is hard to smooth out. Platinum will not expand or contract in heating, and the higher the karat quality of gold used, the better the joining will be.

During the last five or six years the demand for all platinum jewelry has been increasing and this has caused a call for a stiffer or harder alloy. Iridium is used in various proportions to make it harder, a 10 per cent alloy being the most generally used, although for some work 20 per cent of this metal is the proportion. All the fancy lace or mesh work is sawed out of the 10 per cent quality. Parts that are to be set are of pure platinum, while the knife-edge wires—as stems for leaves, flowers, etc., spring parts for hair ornaments, and ring shanks—are made out of a 20 per cent iridium alloy.

To be a successful worker in platinum one must have some knowledge of drawing. The designer may furnish you with a tracing from the design, but in transferring it to the metal there are plenty of chances for mistakes. This, in a sense, is obviated by having the engraver lay it out for you, which, of course, is leaning too much on

others. Better make an effort to do all this yourself. Get good tracing paper, "Vellum" and "Parchment A" are both good, and may be gotten from Favor, Ruhl Co., 52 Park Place, New York. Place on your design and mark carefully, using a 3H Hardtmuth pencil. Some jewelers paste the tracing directly on the platinum, and others prefer to place a piece of carbon paper between and go over tracing with a 6H pencil, thus getting a carbon drawing on the metal. The writer advocates the latter method. In the case of fine lace or interwoven effects, where fine hair lines of mesh work are used, the only sure way is to have it outlined for you by an engraver, or also learn to do this yourself.

Small leaf and scroll work are cut out of from 150 to 170 points thickness of stock in the dial screw gauge, and mesh work out of about 80 points. Where a gold back is used the platinum is usually just a little thicker than the gold, so that in a leaf of 170 points we use about 100 platinum and 70 gold. In making work requiring any carving or modeling, thicker stock, of course, must be used. In this case the work is carved and also hollowed out from the back and punched or dapped up; the hollowed-out parts being thinner, will allow for modeling. Take, for instance, a horse. This is sawed out of about 200 points stock and after being filed up and the head, shoulder, barrel and flank indicated, the parts that are to show high from the front are now hollowed out from the back, using a pair of calipers or a spring gauge to avoid getting stock too thin, then placed on a lead block and punched up with assorted sizes and shapes of hardened steel punches.

As a great deal of platinum jewelry is still being made with gold lining or backing, it will be interesting to the young worker to know how a gold lining is put inside a dog's head or a lizard or other animal, which is all platinum, from the front and sides. The outline is first cut out, usually from a brass pattern, and modeled up, using the punches and lead block, then a bezel of fairly thick stock is bent up and soldered on, using the hardest plat-

inum solder. Now cut up small pellets of gold and lay in carefully, charge on solder and well sweat. After boiling out in pickle, smooth the surface with riffle files. These files are made out of shad-belly needle files by heating the ends red hot, curving with round-nosed pliers, then heat again and harden in water. The temper may be drawn a little. Other good riffles are made out of flat, also round needle files. The turnover effect seen on large work, as lizards, is gotten by rounding the bezel, first filing off, slanting the lower inside edge before soldering the bezel to the front. Another way is to saw out a back of gold, the outline of the front and dap it up well, solder on an extra plate for an inside edge after the "daylight" opening is sawed out.

The skillful artisan on platinum, and, indeed, on fine hand-made gold jewelry, is a combination of designer, modeler, engraver, and jeweler. In large shops where these various workmen are employed there is not the opportunity that obtains in some of the small "cockroach garrets" of New York, and some really fine jewelers are found in these small workrooms, earning big wages and held in high esteem by their employers. There are also foreign jewelers who come to New York. These have worked in Paris, London, Vienna, and other jewelry centers, and some of them are very fine workmen. They are oftentimes very independent and shiftless, and are usually globe trotters. Those that do stick, however, are very valuable to their employers, as they bring new ideas with them that the American jeweler is quick to get onto.

Platinum some thirty-five years ago sold at $6 an ounce, and is now bringing around $155 an ounce, but the price seems to have no deterrent effect on its use in connection with the making of fine jewelry. As a setting for a diamond it has no equal, for it is tenacious and lasting and enhances the tints of the stone. Gradually other stones came to be set in platinum, but outside of the sapphire it is not considered good taste to wear them. Sometimes in made-over goods the large diamonds are removed and rubies or other stones substituted. The ef-

fect, however, is not pleasing. The dull or frosted effect on some goods is produced by the sandblast, using a fine flint. A good satin finish is also obtained by the steel scratch-brush on a rapidly revolving lathe, holding a piece of thin steel against the ends of the brush so as to let the points strike an "end on" mark in the platinum.

There is a loss of about 30 per cent in working platinum, as against not over 5 per cent in gold work. Then, again, it is hard to refine platinum and gold filings and to separate same. Where the scrap metal is sent to the refiner for exchange or remelt, a charge of $1.50 an ounce is made.

The price of platinum making that metal too expensive as a mounting for other than fine diamond work, there is a demand for 14-karat jewelry with a platinum finish. After some experimenting it has been found that an alkaline platinum solution can be made that will deposit a fairly durable coating of the metal with the use of the electric current, as in regular gilding.

The following solution has been tried (among others) and is recommended: Take three pennyweights of platinum,—the regular soft stock, not hard or iridium platinum,— roll as thin as possible, then cut in small pieces and twist and curl up as well as you can so that the acid can attack it readily; put in flask, pour over solution of three ounces muriatic acid C. P., and one ounce nitric acid C. P., and place on sand bath. Platinum does not dissolve as easily as gold, but leave it on the sand until it does, being careful that the sand does not get too hot so as to run risk of breaking the flask and losing some of the platinum. If, after the acids have become heated, there is no bubbling or effervescence, add a little more muriatic acid.

Right here the writer cautions against using any but chemically pure acids put up in glass-stoppered bottles at the chemical works. Certain supply houses have made it a practice of bottling from carboys; the writer has been up against this to his sorrow. Always keep bottle stoppered, closing up instantly after using; even then a gallon

bottle of acid will get weak at the end and necessitate using more in proportion. However, do not worry if platinum does not dissolve in one or two hours; it sometimes takes ten or fifteen hours.

When dissolved, let it evaporate to thick syrup, let it cool, add a half-pint of distilled water; evaporate almost to dryness, then put in clean stoppered bottle and label it chloride of platinum, adding enough distilled water to make two liquid ounces. To make the bath take one ounce of the chloride and mix in a solution of one quart of water containing 25 pennyweights of table salt; stir well with glass rod, then add, drop by drop, a solution of one stick of caustic soda (by alcohol) in half-pint of water, until the solution turns red litmus paper blue. Bath is now ready to be put in tank for heating. Use platinum anode as a means of current connections only, as the only platinum deposited is that in the solution, and must be renewed and made over as often as necessary. To get the best results an article should be polished, then scratch-brushed, dipped in caustic soda or potash solution and hung in bath, using copper wire; the current should be three or four volts; after five to ten minutes remove and scratch-brush, place it in again, take out, scratch-brush and burnish with a bloodstone burnisher; then give the article another dip of about ten minutes, when it may be burnished again and soft rouged. If desired, the burnishing may be omitted, but the coating will, of course, not be as durable.

In the case of a fancy chain composed of enamel ornaments connected by platinum links, the gold edges, rings, etc., not covered by the enamel can be plated in the above bath, thus giving an all-platinum and enamel effect to the chain. Articles with smooth surfaces, like lockets, handy pins, belt and bar pins, where the burnisher can be used to advantage, present a rich and lasting finish after the rouging.

A palladium solution has been recently introduced, made as follows: 1—Water, 8 ounces, 26% ammonia,

1 ounce; 2—Phosphate of soda, 4 ounces, water, 1 quart; 3—Benzoic acid, 3½ pennyweights; 4—Water, 1 pint.

Dissolve 2½ pennyweights of palladium same as platinum, and after evaporating almost to dryness add one-half ounce distilled water, or a little more if necessary to dissolve well, and warm. Now warm solution No. 1 and add. Then No. 2 is added. Boil for a short time until all odor of ammonia has disappeared and the solution has become clear. To this is now added No. 3, and finally No. 4.

Heat to 120° F., use 1 to 2 volts with a carbon anode. Work must be polished bright and clean and the deposit will be slightly lighter in tone than platinum, but takes a beautiful polish and luster. It is largely used in place of platinum on account of a brighter deposit being had in crevices and places difficult to get at in the final polishing.

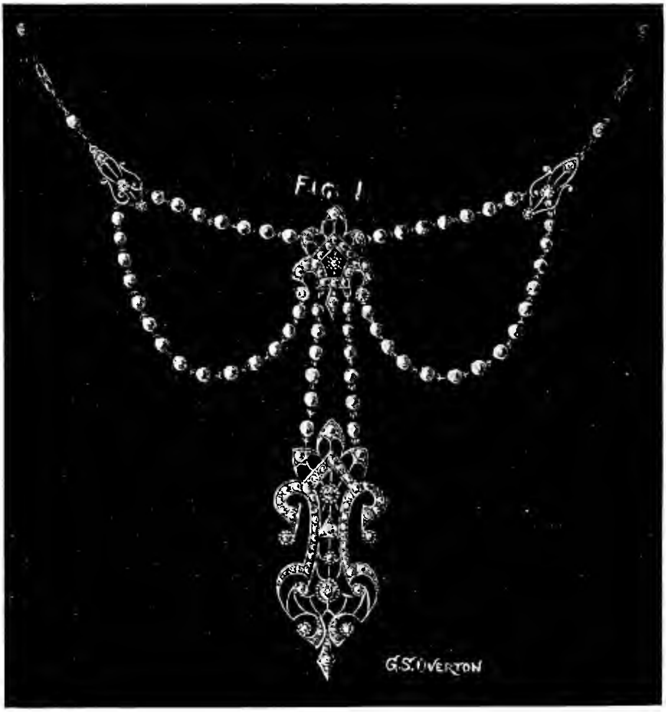
CHAPTER XXVI.

WORKING IN PLATINUM (CONTINUED).

Skilled Labor and Waste of Material Make Platinum Ornaments Expensive—Some Designs That May be Made and Marketed at Low Cost—How to Reduce Shop Cost to a Minimum.

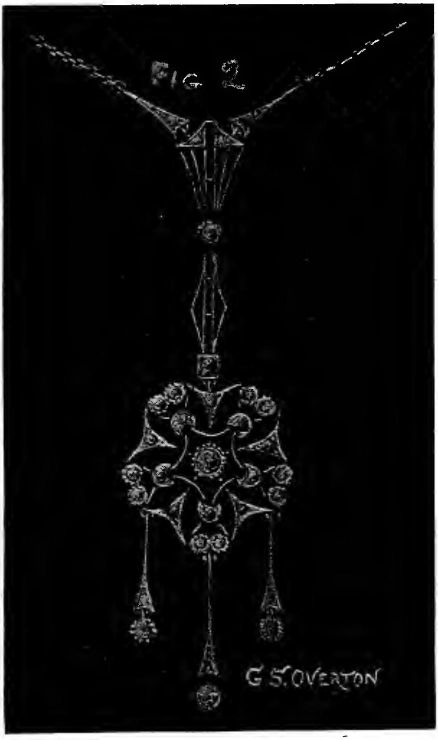
THE most expensive platinum jewelry is sawn out of one piece; bezels, gallery, and the connections on the back, of course, excepted. Where there is a lot of detail, mesh effect, veining, lines, etc., this is necessary. It makes a fine piece of work, but is high priced, the nature and construction of the article calling for skilled artistic labor as well as considerable loss in metal. It is estimated that there is fully thirty per cent loss in platinum filings, and jewelers making fine platinum work get big wages as compared with the average man working in a gold factory.

The great popularity of platinum and the subsequent decline of the sale of fine gold jewelry has prompted the better class of gold manufacturers to make a low-priced line of platinum goods, using similar methods in the production as obtain in the gold line. The finest shops in New York have no machinery or presses. Outside of a couple of pairs of rolls and two or three drill lathes, the equipment is all hand labor. One maker on Fifth avenue uses in his work several thousand small leaves for wreaths, sprays, etc., in a year, all hand made. A small foot press would cut these out at a trifling expense and more accurately, to say nothing of the clean scrap left. This man knows all this, but will not entertain any machine proposition. On the other hand, the gold shops being equipped with all labor-saving devices, employ them in making platinum goods. Their jewelers are trained to make work at a price, hence a compara-



tively popular priced line of platinum jewelry can be made.

The writer remembers one case in point. A New York house made a platinum horse mounting and charged a price double that of a Newark gold concern which had a line of horse dies out of which they had raised quantities of gold goods. With the die a horse was raised in a few minutes, the hand mounting taking something like fif-



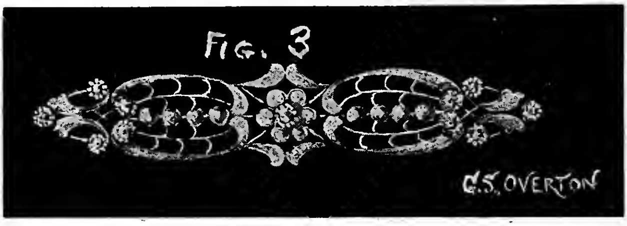
teen hours to make. In spite of this fact, the New York maker will keep on making and selling hand mountings.

The illustrations shown herewith are original designs, which can be made of plate and wire. The plate or flat stock may be made as thin as 120 points in the dial screw gauge, and the wire is at least 10 per cent iridium (15 or 20 per cent is better, stiffer), and drawn down round and rolled flat. The collets, tubes, or hollow wire for

the diamonds may be bought ready made or cut off from lengths of seamless tubing.

The pearls in Fig. 1 are connected by eyes bent on ends of wire passing through pearl and closed tightly. The large ornament is sawn out of one piece, leaving it slightly thicker at lower curves until after the center wires are soldered in. The ornaments connecting the ends of festoon are bent of wire and the end piece for the stone carefully let in. Fig. 2 shows a simple and effective lavalliere, and can be easily made by a good jeweler.

Fig. 3 is a frame of scrolls and leaves first soldered together and the center applied. The half-circles are simply rings cut in two and the leaves and flower can be cut out in almost any jewelry shop where they make flower work and have cutters. Fig. 4 shows a "spready" pendant. The opal may be set by a few beads or an 18-karat bezel carefully let in the platinum cluster.



Making platinum jewelry in this manner, the gold shops are enabled to place on the market fine diamond work that stands up well and the low cost will make the sale. The maker is getting the use of his tools, dies, etc., and his men get the work. These low-priced platinum lines, to still further reduce cost of labor, are also gotten out in gold, set with pearls, etc., and where a man makes

a dozen or more pieces of same patteın the labor is reduced to a minimum as compared with that of getting out one piece only of a design.

CHAPTER XXVII.

RECOVERY OF GOLD AND SILVER FROM SCRAP.

Melting the Refinings—Most Satisfactory Method of Remelting to Secure Fine Gold—Small Quantities Impractical—Separating Silver and Gold—Metalizing Silver—Not Advisable to Do Sweep Smelting in Factory—Recovery of Gold and Silver from Old Solutions.

COLLECT the bench filings, old gold, solder scraps, in fact, everything that is not clean scrap of known karat quality, and spread out well in a paper on a bench. Take a magnet of good size and strength (if you have an old-timer and pretty weak, it will pay you to throw it away and get a new one), and go through thoroughly. The iron wire, scales from files, etc., that will adhere to the magnet will also have some gold dust clinging, so after gently tapping the magnet to loosen as much as possible of the gold, the iron is brushed into a can or iron box for further treatment.

Now take the refinings, and, after picking out the larger pieces of scrap, place the dust in a large iron frying pan and burn over your gas furnace, placing a piece of sheet iron over as a cover to prevent any of the dust from blowing away; upon cooling, put all your gold for refining in a scales, weigh, and add an equal amount of flux. Now put it in a crucible, a safety crucible is cheapest in the long run, and should be previously warmed; do not fill up nearer than two inches from the top, and place in furnace; as the mass gets heated it will rise; when it threatens to spill over, throw in a little table salt, which causes it to settle again. After the mass has ceased to rise, and, in fact, is gradually settling lower in the crucible, it should be left in furnace for at least an hour and a quarter for a two-pound melt (one pound lemel refinings, and one pound flux).

Now lift out of furnace, after turning off gas and allowing to cool a little, and place away to cool. Do not break the crucible until you are sure the mass is solid, then smash and break off the slag, and a button of gold will be found ready for refining. The writer knows of jewelers who at this stage remelt the button in the regular black lead crucible, and, after pouring in wire or flat ingot, as case may be, roll out and cut a piece out of center, test it to get karat quality, and then add gold or alloy to raise or lower to karat desired. This method is not advocated, as it is more or less guess work, and the resultant alloy is not always the same, sometimes paler or redder, and so on. The button usually is from one-half to one karat finer than before melting, so that in a factory making 10-karat jewelry it should be from 10½-karats to 11-karats, and sometimes better still; in a shop making 14-karat and better, it should be anywhere from 14½-karats to 16-karats fine. The reason for this is that the *Guinea* alloy and some of the copper also is burnt out with the lead, traces of iron, brass and other metals, so that we only have the fine gold and silver to get out of the button, the small amount of copper remaining not being worth considering in the calculations. We will presume we have a button of 15-karat gold, weighing 400 pennyweights, and right here would say that, unless for special reasons, would not advise refining less than 500 pennyweights of 10-karat or 11-karat, or 350 to 400 pennyweights of 14-karat quality. It is just as cheap and as easy to refine 1,000 or 1,200 pennyweights as less.

The writer has found it good practice to run down a button of around 300 pennyweights and place it away until he gets four buttons of about the same weight. We now take our 400-pennyweight button of 15-karat quality and figure out how much fine gold we have in the button. Knowing that 15-karat is $\frac{15}{24}$ or ⅝ fine gold, we simply take ⅝ of 400, and 250 pennyweights of fine gold is the result, the remaining ⅜, or 150 pennyweights, being the silver. Fine gold is best recovered from silver in the proportion of 3 of silver to 1 of gold, so that to the

button we add 600 pennyweights of silver, this with the 150 pennyweights already in the button making 750 pennyweights of silver to 250 pennyweights of fine gold. As a matter of fact, it is actually a little less, as some of the 150 pennyweights is copper, but, as we said before, not enough to bother about. Now having gotten our proportions right, we remelt all in a black lead crucible (no fluxes at all), and when thoroughly mixed pour into a large pan or tub, iron, copper or porcelain, full of water and rapidly stirred with a broom handle by an assistant. The higher the crucible is held from the water the better the granulation (my melter stands on a stool). If the melting and subsequent pouring is properly carried out the receptacle will contain a spongy mass, in which the gold will be seen streaked in the silver. Now pour off water, turn the residue into a porcelain evaporating dish or bowl, and place on a sand bath in a forge or under a chimney or flue, with a good draft to carry off the acid fumes. The writer uses a specially prepared "parting acid" supplied by manufacturing chemists. Add the acid carefully, as too much on the start will cause a violent action and some of the gold is apt to be spilled over and lost.

The gold will now be separated from the silver and thrown down, looking like brown mud in the bottom of the dish. Keep pouring off the dead acid, which will contain the silver, into a large crock, or equally divide it in a number of crocks if the melt is large—about four crocks for 1,200 to 1,500 pennyweights of silver. When the acid ceases to bubble or effervesce, and shows no action after stirring with a glass rod, pour off carefully and add fresh acid; keep stirring at intervals with the glass rod, as the silver forms a dense nitrate and prevents the acid from working. As the silver is finally dissolved in the acid, and the gold is all precipitated, wash thoroughly with hot water, then add a pickle of sulphuric acid and water in proportion of one part acid and nine parts water; place on sand bath again and let it thoroughly clean the gold.

If the above directions are carefully followed you should have, after the pickle has been poured off and the gold washed and dried, a rich, clean, golden brown powder which, when shoveled carefully into a crucible and melted, will result in a bar of pure 24-karat gold, ready to be alloyed to whatever karat is desired. No flux is used in the melting of the fine gold, and, while it may be granulated if desired, the writer finds it more practical to cast it into the bar ingot and roll down to about the thickness of a ten-cent piece, cutting into squares for alloying.

To recover the silver, add a large lot of water to your crock or crocks, stir well, throw in four or five cupfuls of salt, and let it stand over night; next day take a testing glass, procured at any chemical supply house, put in some of the liquid and add a solution of salt and water; if no white powder (chloride of silver) settles, it shows that the silver is all in bottom of crock. An excess of salt will do no harm. Now pour off the liquid and put the silver into a large wash basin; wash well with several changes of hot, and, finally, one of cold water; mix a solution of sulphuric acid and water as before, and cover over the silver, then drop in a few pieces of scrap sheet iron and let it stand a couple of days, mixing occasionally. This is called metalizing the silver, and is necessary, for if the silver were placed in a crucible after precipitation by the salt, by reason of the finely divided state it is in, it would go through the crucible and also evaporate and be lost.

When the silver is almost black all through, it is again well washed, dried, and mixed with about one-quarter its weight with the same flux used in the refining of the button, placed in a large sand crucible (previously warmed) and melted as a button. Cool, break and recover the button, then remelt, granulate or cast in bar form as desired, and pure, bright, clean silver should result. There are other methods of metalizing, such as zinc, caustic potash and sugar, hanging in pieces of copper in the crocks, etc., but the writer has found the iron

treatment, after all the silver has been thrown down by the salt, as the most practical and expedient.

A sand bath can be readily made out of sheet iron; one about eighteen inches square and about three inches deep will be large enough for all operations; rivet four strips on for legs, fill with cheap sand, and place over an ordinary hot plate gas burner.

Some manufacturers, working in a small way, with whom the writer has been connected, send their buttons to the United States Assay Office, receiving therefrom a check for the gold and silver recovered, less charge for refining, or, if preferred, the fine gold in brick form, and a check for the silver. The only reason I have been able to find for doing this is a lack of technical knowledge, as the assay office does not refine at a loss, and, furthermore, there is often an interval of two weeks before a report is made. Even the small manufacturer has an equipment for melting, with a man who can be trained in the handling of the acids, washing out, etc., and the extra expense of a carboy or parting acid with a few safety crucibles is trivial. The writer has collected the lemel, run into a button, granulated, refined, melted, and gotten the fine gold (as high as 900 pennyweights) in less than two days, all ready for alloying over again. The silver, of course, may be recovered at your convenience in time for the next refining.

In the matter of attempting to get the gold and silver from the polishing room sweepings, hand washings, rinsings, etc., the writer advises allowing sweep smelters and refiners to come in and bid on the work, as the cost of a sweep reduction furnace, and the time spent in reducing large bulk for the little percentage of gold is too great to be maintained in single factories.

A point well worth keeping in mind is, that in a factory where precious metals are being handled, no waste should be thrown out; all paper, rags, old aprons and other inflammable material should be burned in a large iron pot in the forge, and the ashes deposited in a bin or other metal can or box; old crucibles should also be

saved, no matter how clean they may look; the writer once got 50 pennyweights of 14-karat gold out of an apparently clean lot of old broken crucibles that had lain in a box probably for years, and through carelessness in charging the melts to the melter and reweighing after melting, had been lost sight of.

To recover the gold and silver from old cyanide solutions, put all together in one large crock; then get some pieces of zinc, say three or four ounces, roll them out thin, scrape clean and bright, and coil or twist it up well, then drop in the crock; stir occasionally during the day, letting it remain over night, when gold will all be deposited on the zinc. The liquid may now be poured off through the regular rinsing and the zinc well washed with clean water; now make a solution of commercial sulphuric acid one part and water nine parts, about a pint in all, and pour over the zinc, which has been placed in an evaporating bowl; in a short time the zinc will all be taken up in the solution and the gold, silver, copper, etc., will be precipitated as a muddy sediment; this is well washed, dried and mixed in with filings and other scraps for refining.

After recovering the fine gold from the refinings and you wish to test the gold to see whether there is still any trace of silver left, take a few pennyweights, dissolve in two parts of muriatic and one part nitric acid, and the silver, if any, will be precipitated as a powder in bottom of flask. The gold may be recovered by largely diluting with water and throwing in a handful of sulphate of iron (copperas); this will throw down the gold, when it may be washed, dried and melted, as a button of pure gold. Zinc will recover gold from all cyanide solutions, and sulphate of iron from all acid ones.

CHAPTER XXVIII.

REFINING POLISHING SWEEPS.

Use of the Magnet—Separating the Silver—Recovering Platinum—Precipitating the Gold—Metals Recovered Are Commercially Pure—Use Caution in All Work with Acids.

THE refining of filings and polishing sweeps is not a difficult operation, but to obtain the proper results it requires careful and close attention. The average shop can get out nearly the whole value if these details are followed:

Spread out filings on a large piece of paper and go through carefully with a pair of tweezers to get any solid pieces of gold or platinum, then sift well through a strong steel magnet. Speaking of magnets, see that there is plenty of strength; do not use an old one that may have been in the factory a number of years and be played out. Having gotten a good one, always keep a piece of steel on the two ends to keep the magnetism from running out. In passing the magnet through, small atoms of gold and platinum will adhere to the iron or steel filings. These may be put into an old pickle crock (sulphuric acid and water), which will eat the iron or steel and precipitate the precious metals. When a sufficient quantity is recovered these filings are placed with the others for separating. If a lot of oily waste, buffs, etc., are in the stuff to be refined, the mass should be put into an iron pot or large iron frying pan and burned out over a gas plate before putting magnet through.

After separation place in a large evaporating porcelain dish, and to every ounce of filings add 3 ounces of chemically pure muriatic acid and 1 ounce of nitric acid. While any quantity of filings may be treated, yet it hardly pays to put less than 20 ounces through at a time. If

filings are largely gold, the acids, which are previously mixed in the proper proportions, should be added slowly and a little at a time, or a rapid action would result in the mixture rising and spilling over the edge, thereby losing some of the metals. The dish should be placed on a sand bath over a gas plate burner and should be kept hot. A glass funnel may be placed over dish to prevent loss. When all is dissolved, which may be ascertained by stirring with a glass rod, turn off gas and let cool. Then pour into large crock in which are ten or fifteen quarts of rain or distilled water, or water which has been boiled and cooled. Let stand a few hours, or until next day, and a precipitate will be found on bottom of crock. This is chloride of silver.

Carefully siphon liquid into another crock, or pass through a funnel with filtering paper to recover any particles of silver which may be still in the liquid; mix up about 20 ounces (for 20 ounces of refinings) of fresh powdered sal ammoniac in a little water, pour in liquid and stir well. In a few hours the platinum will be found on the bottom of the crock. The liquid is siphoned off into a fresh clean crock, filtered to recover any further traces of platinum, and with the precipitate well dried and subsequently melted in the regular furnace.

The gold is recovered from the liquid by adding about an equal bulk of water and dissolving about 20 ounces of sulphate of iron (green copperas) in a little water, add and stir thoroughly. Let stand for a few hours, pour or siphon off liquid, and the gold will be found deposited in bottom of crock in the form of a muddy brown sediment. This is collected, dried and melted in regular crucible. The liquid will contain traces of all the metals, also the copper used in alloying, so should be poured into sink for further recovery by the refiner. The metals recovered this way are not chemically pure, only commercially so, and are used in the general run of jewelry manufacturing. It is safe to assume that in the melting of the platinum all traces of silver, copper, etc., are destroyed, as the high temperature would cause these

metals to volatilize so that the only probable metal remaining would be iridium. Sometimes this metal is not dissolved and is thrown down with the silver. To separate, dissolve the silver in nitric acid only, dilute well with water, and hang in a few pieces of copper, old boiling-out pans will do, and in a day or two the silver will be thrown down, when it may be dried and melted with a little borax. The iridium, trace of platinum, etc., not being attacked and dissolved by the nitric acid, are recovered from bottom of crock and melted.

If all details are carefully carried out, the average shop can get out its own filings. In mixing and adding filings to acids in the first operation, the acids must be well heated before action, especially on platinum, takes place. The acids may be put in dish first, well heated, and the filings sifted in, a little at a time, stirring well with a glass rod, so that metals are constantly exposed to the acid. The amounts of sal ammoniac and copperas (20 ounces each) are for about a like weight of the metals and should, of course, be reduced or increased in proportion. All work with acids should be done in a separate room or where there is large chimney to carry off fumes.

Some refiners use oxalic acid in place of the sal ammoniac; the results are the same. To be sure of getting strength it is best to buy sal ammoniac in lump form and pulverize it in a mortar as required.

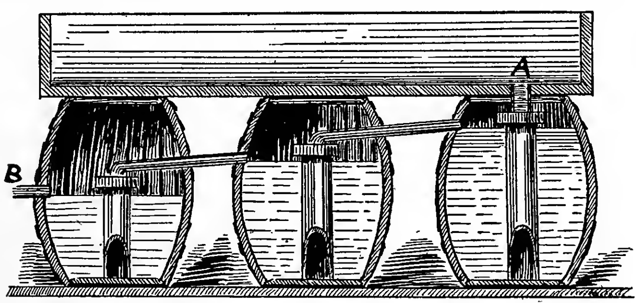
CHAPTER XXIX.

FILTRATION OF WASHINGS.

The Filter Press, Cloth Screens and Excelsior Packing—A Practical and Economical System—The Use of Copperas —Lead Cylinders in Place of Tile for Enameling Shops —A Reckless Habit—Recovery from Solutions.

SINKS and tanks, barrels or other apparatus for washing purposes, and the subsequent recovery of the precious metals naturally engage the attention of jewelry workers. There are a number of methods in work to-day, including the filter press — a system of pumping the water through a series of canvas bags, pressed together to exclude the water, after which the bags are opened and the residue removed for refining. Another means is that in which a large tank is fitted with a number of cheese-cloth screens to catch all particles as the water slowly passes through; still another way consists of packing the bottoms of the tanks or barrels with excelsior, keeping the feed pipes near the bottom of each so that the fluid is filtered through.

The drawing shown herewith, whereby three kerosene or oil barrels (whiskey barrels will also do) are



Sink for Filtering Washings.

fitted with ordinary drain tile pipes in which the water washings pass through lead pipes from the sink at A, and into the sewer at B, is, while not a new idea, as good as any method, and is practical and economical.

It is well known that nearly all the gold and silver passes into the sink in the form of filings, or very fine particles. Now these are mixed with soap, grease, etc., and are too light to sink, consequently, unless forced to the bottom of each barrel, they float on the surface, passing from barrel to barrel, and are eventually lost. Now all particles being mixed with the water and acid and having gained a pressure downward, will nearly always stay at the bottom, it being more difficult for a particle, no matter how light, to rise than to fall.

No sawdust, sand or other like matter should ever be put in sinks. Sulphate of iron (copperas) should be put in the barrels from time to time, or a small bunch of binding wire (iron) will do. The reason for this is that in case gold or silver solutions are poured in the sink, either by accident or otherwise, the iron will take up the acid and precipitate the precious metal. Then again there may be particles of gold, or even large pieces, left in the sink and gradually washed into the barrel, and at different times, nitric, muriatic or sulphuric acids poured in, having a tendency to form aqua regia and dissolve the gold or, in case of nitric acid, the silver. If the iron were not present, this would all pass into the sewer in solution.

In an enameling plant lead cylinders should be used instead of the drain tiles, as the hydrofluoric acid used in etching the enamel would also dissolve the tiles.

Now it is a reckless and foolish habit some jewelers have of pouring all old solutions containing gold and silver into the sink, then allowing a few gallons of water to run in to "thin it out." By reason of the sudden influx some of the solution is bound to be forced through before the iron has a chance. All cyanide solutions should be poured into a large crock, acid solutions in another, and at suitable periods the metals therein

recovered as described in other chapters. Those jewelers doing business in localities not having sewer connection may recover everything by allowing the waste waters to run into a "soak away" or cistern without a bottom.

A good sink is also made by connecting each barrel with lead piping about a foot from the bottom and having the last discharge pipe near the top of the barrel. It should be mentioned that in the case of the filter press the liquor is first neutralized by mixing lime and water and adding before starting the pump. Alum in powdered form is also added if the washings do not clean up sufficiently for filtering.

CHAPTER XXX.

TESTING FOR PURE GOLD.

Acid Testing Solution—Dissolution and Evaporation of the Metal—Elimination of Silver a Bug-a-boo—Precipitating the Platinum by Sal Ammoniac—For Chemically Pure Gold—Process Used at United States Mints.

A SOLUTION of 1 ounce of C. P. nitric acid and 4 drams of muriatic acid will turn 22-karat gold a dirty yellow, 20-karat gold, brown, and 18-karat, or lower, black. This testing acid should be kept in a glass-stoppered bottle. The only safe and reliable test for 24-karat or pure gold, is to roll the metal as thin as possible, cut into little squares, crinkle it well, so that the acid will attack it easily, and place in a long-necked German flask.

Get the weight of the gold to be tested and to every ounce of the metal add 6 ounces of C. P. nitric acid and muriatic acid mixed in the proportions of 2 ounces nitric to 4 of muriatic. To hasten the action of the acid, place the flask on a sand bath over a gas heater out of doors, or in a forge where the poisonous vapors are carried off. An ordinary porcelain dish will answer for the dissolving and subsequent evaporating, but the long-necked flask is more conveniently handled and the risk of foreign matter getting in the solution is greatly lessened.

In a short time the gold will all be dissolved, the lead, tin, copper, and other baser metals will be destroyed, while the silver, if any, will be found in the bottom as a white, pasty mass. The elimination of the silver in the refining is the bug-a-boo that the jeweler has to look out for, as in the reduction of the lemel (bench filings, scraps, old gold, etc.) silver is largely used, as explained in preceding chapters.

To resume, the liquid, after cooling, is poured off carefully,— leaving the silver chloride in the bottom of dish for further treatment for remelting,— then placed again on the sand bath and evaporated almost to dryness; let it cool and add several times its bulk of clean, cold water. If you have three or four ounces of pure gold in work, the solution should be poured into a large crock with a capacity of from four to five gallons. Better have an excess of water, as the acid is thinned out more. A little caustic soda or potash may now be added, to further weaken or kill the acid and render the task of precipitating the gold much easier.

To precipitate the gold from the solution a couple of handfuls of sulphate of iron is thrown in; stir well with a glass rod, let stand for a few hours, and the gold will be found on the bottom of the vessel as a dark brown mass. If you have reason to believe that there is platinum in the gold, a strong solution of sal ammoniac should be stirred in before the gold is thrown down with the iron. The sal ammoniac will precipitate the platinum and of course the gold solution is poured into another vessel before using the sulphate of iron. The gold mass should be washed several times with hot water and finally with cold, and then treated to a bath of 1 part sulphuric acid in 9 parts of water, again well washed and dried. The gold should now present a rich golden brown color of about the fineness of flour of emery and should contain no lumps. Place in a crucible and remelt, and a button of pure gold will result.

It would hardly pay to put a few pennyweights of pure gold to the foregoing test, and sometimes gold that is in doubt as to its being absolutely 24-karat is scraped a little and touched with a glass stopper which has been kept in a bottle containing a testing acid of 4 drams of C. P. nitric acid to 8 drams of C. P. muriatic. The presence of silver is detected by a whitish spot showing, which is soon turned black under the action of the sulphur in the air. The presence of silver cannot easily be

seen in a small surface, however, as the amount is almost infinitesimally small.

To get chemically pure gold of an average purity of 999.96 parts of gold per 1,000, the fine gold is dissolved as above, excess of acid driven off, and alcohol and potassium chloride, or sal ammoniac, added to precipitate traces of platinum. The chloride of gold is then diluted with distilled water in the proportion of half an ounce to the gallon, when the solution is allowed to stand three weeks. Syphon off carefully and add oxalic acid in crystals from time to time, until the solution is colorless, the precipitation of the gold toward the end being aided by a gentle heat. The gold is now in a spongy mass, and is well washed repeatedly with C. P. muriatic acid, distilled water, ammonia water, and lastly with distilled water. It is then melted in a crucible with a little pure bisulphate of potash and borax, and poured in a stone mould.

The process now in use in most of the mints in the United States for producing pure gold, is called the Wohlwill process, and is an electrolytic one. Briefly described, ordinary 24-karat fine gold is used as cathode and anode, and these are suspended in a solution in which a quantity of free muriatic acid is contained. Gold is also dissolved in aqua regia (as already explained) and the chloride added to the bath. When in action the gold is dissolved from the anode and is deposited on the cathode in a spongy mass. The silver is converted into a chloride and either remains upon the anode as a slime or sinks as a sediment. Iridium and platinum do not dissolve. All other metals pass into the solution, and, always providing there is free muriatic acid, never deposit with the gold. The gold averages 999.8 and higher.

These last two processes, while very interesting and instructive, are not practical for the average manufacturing jeweler, and if he follows the comparatively simple instructions given in the first formula he will get a fine gold that will stand any stamping law test.

CHAPTER XXXI.

KEEPING TRACK OF GOLD.

Much Petty Pilfering May be Prevented by Proper Methods in Giving Out Stock—The Average Shop Force is Cosmopolitan—Temptations are Numerous—Old-Time Methods—Factory System Necessary and Welcomed by Honest Workmen.

AT quite regular intervals we read of the arrest and conviction of an employee or employees of jewelry factories for stealing gold, silver, or other precious metals. In the writer's opinion, a lot of this petty pilfering, often running into large amounts in the course of years, could be prevented if proper methods were used in charging work to the men and in keeping track of the same.

One large house which the writer was with several years ago, used to hand a man a bar of gold or silver, telling him to cut off what he wanted, and no record was kept of it. This was all very well at the start, as in the early years of this firm's existence they had a small, sort of "family" force of employees, every one known to the other, and all honorable. As time rolled on the business grew, until ten, then twenty times the number of the original workmen were employed. Gold began to be missed, also silver, and eventually one of the very first men hired was convicted of theft.

This firm used to maintain that they wished to put men on their honor. This is a very pretty sentiment, and might do in isolated instances or under certain conditions. The plain facts are these: Jewelers are recruited from all over the world. They come here, oftentimes, largely imbued with the idea that this country owes them a living, or, if born here, may nurse a real or fancied grievance against the foreman or the firm; some one fig-

ures it out that he is not getting as high a wage as he ought, and proceeds to make up the difference in the most convenient way.

An apprentice boy running errands gets wise to slip-shod methods in the stockroom and filches occasionally. The melter abstracts a few pieces of fine gold from the alloy given to him to melt. Some workmen slyly take a piece of plate or wire from their neighbor's bench, or hang around until the rest have gone and clean out a few filings or cups. The press hand fails at times to turn in all of his "scrap," and a slice may be clipped off the gilding anode now and then. A number of men start all right, but temptation constantly being in the way, some of them are bound to fall.

The indiscriminate handing out of raw material to men tends to give them a low estimate as to the value of the metal, or at least invites carelessness in keeping track of it. As a rule, a man will cut off more stock than he actually needs for the job in hand, to allow for possible mistakes or accidents in rolling or drawing, etc. If he loses some of it he figures that the man who sweeps up will find it all right.

Another old-time method which, I think, is becoming obsolete, is the shot system, in which lead or copper shot are balanced on the scales with the work and put into bottles labeled with the men's names. This way is not accurate enough; the bottles get mixed, or in one way or another the shot gets put into the wrong bottle, and so on. Another bad habit is the letting of one workman get a piece of stock from another, without first crediting it off and charging it to the last man. Sometimes a man will go ahead and finish his job and then tell you he got material from so and so to finish with.

A newly prepared alloy of gold going to the melter should be weighed as soon as it comes from the ingot and before rolling, not because of any doubt as to the man's honesty, but simply as a part of factory system in keeping track of the metal. Shots may be left in the crucible, sometimes amounting to several pennyweights,

or they may be spilled over in pouring. The gold should also be tested at times to see if karat fineness is up to standard. The writer has known of some of the brass weights getting into the alloy by mistake, and in the matter previously mentioned, it was the poor acid color finish that gave the clue which finally pointed to the melter as taking fine gold, thereby producing an alloy lower than 14-karat.

As fine gold or silver is bought from the assay office, bank, or refiner, it should be charged to the factory, and the man who does the alloying should be advised that it is pretty much up to him to see that the gold account balances each month. The scales should be tested each day, must be kept clean and under a glass case. The stock should be weighed, using weights, and should balance to a grain. Record is kept in a book, and should be done by one person. About three per cent is a reasonable amount to allow for loss in gold and silver, although in the case of mountings, cluster work, etc., ten per cent or more is not out of the way.

It is a good plan to balance up each man's box every week. This can be done without interfering with his work, if the men are notified that at the most convenient time for them during that day, their boxes will be balanced. All honorable workmen will heartily endorse a system which keeps track of the precious metals. Many of them have at times had the unpleasant experience of being under suspicion.

As a rule, the men will get together and help hunt out the thief for their own good. The careful weighing of stock, entering up and crediting off, may take a few moments longer, possibly resulting in the customer taking a later boat for Europe or Patagonia (factory men will recognize this threadbare dock joke), but in the long run the firm will be the gainers and a better class of men will be employed. The crooks usually go where the picking is the easiest.

CHAPTER XXXII.

FIGURING SHOP COST.

From Design to Sample Case—Details of Pin-Making Cost —Percentage for Shop Expense is Sometimes too Low— Marking the Selling Price—Make Durable Articles— Thin Goods Unprofitable—Weighing for Metal.

A DESIGN having been approved by the members of the firm, it is submitted to the salesmen for their approval or condemnation. In the event of favorable decisions and an estimate of total amount of first sales, a sample or pattern is usually made by hand. This sample is sometimes shown to certain customers, and their opinions asked for as to whether it will likely be a seller, etc., also for any criticisms as to construction or ideas in the design. Customers often give valuable suggestions as to getting up the article so as to compete in price with similar patterns. It having been finally fully approved, the sample is placed in the diemaker's hands and eventually reaches the toolmaker for the necessary cutters. When all dies and tools are made, an order is given to the raiser or stamper to get out a quantity —in first-class 14-karat factories fifty is usually the number of the first lot. After raising in the die the goods are passed to the toolmaker, who puts them through the cutters for trimming, thence to the jeweler, enameler, polisher, finisher, and so on, to the carding room.

It having been asked as to how the large manufacturers figure costs of making new goods, the writer gives here the system employed, with slight variations, by the leading makers of fine and 10-karat jewelry. A pattern book is used in which spaces are marked off. We will presume a pin is in process of making. The design is drawn very carefully in the book; a tracing may be made of the original design and transferred to the book. At all

events, be sure that the drawing will be exactly the same size as the finished article is to be. This will save a lot of subsequent trouble and annoyance, especially in the case of lockets or bib pins, or anything where the different sizes run close. On the right-hand side of the design write, Gold = $3.20, and in column form add — Raising $.10, Making $.60, Enameling $.30, Polishing $.10 and Coloring $.10, making joint and catch $.03 (or patent catch if used), setting $.90, half-pearls $1.20, finishing $.20. To these figures from fifteen to twenty per cent of the total is added for shop expenses.

In small shops, where the non-producing force is small, the foreman doing the melting and raising, and in some cases helping out in other departments, ten per cent for shop expenses is put on. This is an unwise procedure, as all shops figure on growing, and as they expand goods figured on the ten per cent basis are being made at small profit, if any. The larger the factory, the bigger the clerical force and tool room; consequently, an increased percentage is needed to cover the expenses. The foregoing figures, of course, are merely given as an example. The total is $6.73; add twenty per cent and we get $8.08. One manufacturer, in addition to this, puts on one-third of the cost of enameling to cover the repairs, chipping, maintaining the enamel room, etc., so that the enameling would be 40 cents instead of 30 cents.

Always make a note of how many pins you are figuring the cost of, that is, how many were made in one lot the first time. Under the design, mark the die numbers (all dies should be punched), cutters, thickness of and kind of stock used. In a convenient space mark the number and sizes of half-pearls first used in the pin. All these tips will be better understood and appreciated when you have made a couple of hundred new patterns, and six months or more may elapse before you get a duplicate order. A glance at your book gives you all the details.

After the goods leave the factory and are in the office for the additional figures, a straight fifty per cent is put on by some manufacturers. Others put on twelve per

cent first to cover the subsequent taking off of ten per cent (as an inducement to the buyer), then the fifty per cent. Other firms, having put on the regular profit, size up the article and try to gauge it as a successful seller. Taking a chance, if it looks good, they clap on an extra twenty-five or even fifty per cent. This is all right enough if the pin sells. Makers who put on should also be willing to take off (for their own good). Some stuff would turn over faster and be reordered if figured a little lower in cost.

Avoid the error of making goods too thin on the start. Articles sold all over the country and returned because of defection, to be replaced by more substantial and consequently heavier goods (always at the same price) often means wiping off a goodly slice of the profits. It is always better policy to make a durable piece of goods and get a reputation for making such. It is generally safer for the man who figures the factory costs to stick pretty closely to actual figures. The gold, of course, must be put down exact, as otherwise the gold account would not balance. But sometimes a little discretion may be exercised. Thus, if a man gets $2.50 for raising fifty pins, the raising is put at 8c. or more, instead of 5c.; the making may be 38c.—put it at 40c. This is done to cover little leaks that will creep in, and also with a view of being on the right side of the ledger at the end of the year and showing a slight "factory" profit if possible.

In the matter of weighing the pin to get the metal, some makers weigh as it comes from the jeweler and before polishing, others weigh the finished article, figuring that everything that is taken off it in polishing, cutting for enamel, setting, etc., is in the factory and will be recovered. While undoubtedly some of the gold is never recovered, yet the writer inclines to the latter method as being the nearest correct way of figuring, the loss of gold being charged against the factory, with the slight margins of figuring aforesaid to offset this. In dollars and cents, try to have amount of goods shipped from the factory, plus the metal on hand, with labor on same and

material, etc., at the end of the year balance the sum total charged against the factory.

In spite of all this, in dull seasons the factory will, of necessity, run behind, as a place equipped for a business of say $300,000, and doing perhaps $40,000, will be all to the bad unless smaller space is used, non-producing force is reduced, etc. This, as mentioned in a previous chapter, is not always good policy, as the organization is ruptured, and a sudden rush coming on, you are not prepared to handle the orders.

CHAPTER XXXIII.

REDUCING LABOR COSTS.

The Rise of Specialty Shops—Producing a Better Article at Lower Cost—Economy in Buying Findings—Coloring and Soldering Done Cheaply by Specialists—Fear of Designs Being Copied—Light Weight "Leaders."

THE manufacturer of jewelry, especially if new in the business, must, if he would exist, pay close attention to the cost of production. There are three items to be considered, viz.: gold, stones, and labor, and in fine gold shops these generally average about one-third each. In other words, a manufacturer doing a business of $300,000 generally pays $100,000 apiece for the three items. He cannot get his gold any cheaper, and the stones usually cost the same to each buyer, therefore he must concentrate his energies on ways to reduce cost of labor.

With this object in mind, a number of houses have started up, making a specialty of one article or process, and by doing this one thing over and over again the labor has been reduced to the extent that others could not possibly have a look in. Not alone that, but a better article is the result. In the matter of making findings, or raising parts of jewelry to be afterwards assembled by the individual jewelers, who embellish them with little finishing applied pieces, is this strongly in evidence. New shops, recognizing these conditions, are quick to take advantage of them, and as a result a design may be made in Newark, the die and stamping done in Providence or the Attleboros, the "strikes" returned to be made into brooches, links, scarf pins, etc., as orders may call for, then back to Providence for shading or coloring, and yet a better article is gotten at a considerable lower cost than

would obtain if the same thing were made and finished in one shop.

Special stampers will raise work, and make money at it, about five times as cheap as the average all-around shop can do it. A piece of jewelry an inch or so square will be made Roman or rose finished, or lapel buttons "shaded" in these special shops at surprisingly low cost; plain soldering (hard) of small articles at a gross price not much above the ordinary dozen cost. The average chain as it runs, used for necklaces, lorgnettes, bags, etc., is given a Roman finish, or joints and catches are hard-soldered on pins in quantities so cheaply that a small shop cannot afford to do it for themselves. Specialists in findings will make tools and raise your goods cheaper than you ever dreamed of. How can they do it? Simply by being better equipped for doing *just this one thing* than is any one else.

The old-time factories make their own pin tongues, joints, and catches, excepting the patent ones, some of them even making their own settings. This was all very well years ago, but the cost of making these parts to-day is such that, by the time the selling cost has been determined, the price is skinned to death by the other fellow, who has been buying his joints, etc., at about one-tenth the cost of making them. Gold has got to be plump. It would not pay a concern to handle lower than plump quality.

A great argument handed out by the dowager jewelers, is that if they give out their die work, some one else will see it and copy it. A man ought not to be in business if he fears competition. While there have been cases where dies have been copied and sold to rival concerns, these are rare. The goods themselves are bound to be copied if they are good sellers, and competition is the life of trade.

In the matter of gilding, shops that make a specialty of this have an equipment and system that keeps track of every grain of precious metal in solution and a thorough knowledge at all times of amount deposited. The

dynamo is fitted with rheostat and voltmeter and the tank also has a rheostat for further reduction of current, so that no gold is *burnt* on, or wasted, in other words. This is made possible by giving sole attention to just coloring and nothing else. The average shops figure from five cents up for gilding a pin or brooch. These special colorers will do better work at less than one-half the cost.

One large house made rope chain costing $15 per fifteen-inch lengths. Another concern started up, and, by introducing up-to-date methods in labor production, sold a similar chain for $11. To this day the superintendent of the larger house tells me he cannot figure it out how the other concern is making any money. But they are, just the same.

On the other hand, goods can be figured too close, so that they are made at a loss. These go into the "leader" class, but it is obvious that too many leaders will be disastrous. A common practice among firms making similar lines, as bib or handy pins, etc., is to get up a special light-weight series and put them on the market at a price calculated to knock the other fellow's eye out. One large, old-established house makes a line of pins which is sold actually below cost. They get back, however, on their other lines. Getting a reputation for cheapness by first introducing the low-priced article, they proceed to unload the profit-bearing goods, and, as an old-time traveling salesman once remarked when asked if he could sell a certain line of jewelry: "I'll sell it to him if he isn't looking." Having once gotten the retail man's confidence, it is not so difficult to sell goods with the reputation for cheapness and reliability once established. Younger shops starting up would do well to keep in touch with makers of parts for jewelry instead of laying awake nights trying to figure out how to get out blanks or other material with a poorly equipped plant.

CHAPTER XXXIV.

TIME AND LABOR SAVERS.

The Vacuum Cleaner in the Factory—Of Sanitary Value as Well as a Money Saver—A Shop-Made System—A Live Steam Pipe for the Sink—Quenching Gold and Silver Work.

THE practical use of the vacuum cleaner in jewelry factories has engaged the attention of the larger fine gold manufacturers, and one or two of them have had machines installed. The writer recently accepted an invitation from the superintendent of the largest factory of fine platinum and gold jewelry in Newark, and inspected the vacuum-cleaning apparatus. He learned that, so far as any additional recovery of gold, filings, dust, or pieces dropped, was concerned, the results did not warrant the expense of maintaining the cleaner, but the firm kept it in use for sanitary reasons. It should be said, however, that this particular shop is floored with corrugated sheet iron, thus affording little or no opportunity for the precious metals to get lost.

Now there are other factories, not so equipped, perhaps with just plain board floors, or those covered with tar paper, or, where the jewelers work, a few pieces or sections of slats are laid down. Then again the factory may be an old one, several years established in one building, and thousands of dollars' worth of gold and silver in dust form are wedged in the crevices of the floors, walls, and even ceiling. The recovery of a great deal of this metal can be accomplished by a vacuum cleaning system, which can be installed by your own toolmaker by simply attaching a rubber tube to the suction box of your blower. The nozzles for the floor, corners, walls, etc., you can have made. The rubber tubing should be large, about two inches in diameter, in order to take

up small pieces of waste and other matter. A factory with a polishing room, also an enamel furnace, has a blower which is powerful enough to draw a fifty-cent piece through 150 feet of pipe. The expense of keeping this apparatus is practically nothing, as there is nothing to get out of order and the cost of operating is slight.

It will be found a saving proposition if all men working in gold are kept together, with rolls, lathes, and drill presses as near as may be convenient. Another thing which soon pays for itself is the putting in of a large brush on the inside edge of the sink so that the workmen may brush out their nails. Some factories wash all aprons and find it pays, and also insist upon every employee wearing an apron, for the reason that the gold or platinum is more easily shaken off than if it lodges on the wearing apparel.

Upon reading advertisements of makers of gold alloys the writer notices that one concern uses the argument that, with his alloy, the number of remelts is greatly lessened, thereby saving a loss in the gold. It isn't the gold that burns out; it is the copper, or the alloys that are used. The more times alloyed gold is melted the better quality it is. Pure gold melts at about 2,000° Fah. and may be kept in a molten state for an indefinite time without losing any of its weight, even should the heat be increased. This little tip still further impresses on us the importance of keeping alloyed gold well covered with powdered charcoal, while in the melting crucible.

A live steam pipe swinging in the sink, to be used in the various cleaning of bowls or for rapidly heating water, is a labor-saving device much in use to-day. Cement-covered work is soon cleaned off by this means, with a handful of common washing soda also thrown in the bowl. Where hollow work has been chased and the inside is filled with alum, always steam in plain water first. The "steamer" is also very useful when it is desired to heat alcohol to facilitate the dissolving of shellac from stone-set work. This is done by placing a cup or vessel containing the alcohol into the larger bowl

which has the hot water and the steam pipe. There is no danger of the alcohol becoming ignited this way.

In raising work in the die, some of the drop hands place a great deal of faith in the quenching of red-hot pieces in alcohol before each operation. The writer finds that the work is not softened or made more pliable thereby, and the only solid excuse for using the spirit is, that it cleans the surface from oxide, cooling the work at the same time. The same results can, of course, be gotten by boiling out in pickle. Silver can be quenched by throwing into a solution of cyanide of potassium and water. This removes all oxide and presents a pearly white surface. In all events, work after annealing should always be clean before putting through the next operation.

CHAPTER XXXV.

SOME SHOP PROBLEMS.

In Response to Subscribers' Inquiries—Filling in Letters Engraved on Ivory—Mixing Aniline Colors—Working 18-Karat Gold—Alloying Coin—Heavy Rolling to Close Grain.

"WILL you kindly publish how to mix paraffine and aniline used to fill in letters engraved on ivory, etc.?"

Letters engraved on ivory are best filled in with black lacquer applied with a finely pointed pencil brush. Broad incisions may be filled in by using a composition of asphaltum, some paraffine wax and a very little beeswax. This mixture is applied with heat and leveled off with pumicestone. The ivory should be placed on an iron plate or pan and slowly warmed.

A less risky method is to dissolve black sealing wax in alcohol and paint on when thinned to the proper consistency. Another black paint is made of amber varnish dissolved in spirits of lavender. A good filling is also made of 12 parts of pure beeswax to 1 of litharge. A good black aniline varnish is made of aniline black, 2 parts; gum lac, 3 parts; 90 per cent spirit, 45 parts. Dissolve the aniline in as little as possible of a mixture of alcohol and concentrated acid, then add to the alcoholic and gum lac solution.

Aniline colors, which are insoluble in water, may be rendered soluble by mixing gelatine in acetic acid (of about the thickness of syrup and adding the aniline color in the form of fine powder), stirring well all the time. The mixture is then heated over a water bath to the temperature of boiling water, and kept at that heat for some time. Colors in this state, if a very clean gelatine syrup

is employed, are useful for many decorative purposes, as filling in of spaces in ivory, wood, paper, etc.

A good ink for ivory is made of five parts sodium silicate dissolved in boiling water and adding five parts of liquid India ink. Only sufficient water should be used to make the liquid flow easily.

Probably nitrate of silver is the most satisfactory of all the various processes for blackening ivory. Procure 50 grains of nitrate of silver and dissolve in 1 ounce of distilled water. Paint on with a small brush, let dry, then place in the sun.

* * *

"I have always had more or less trouble in working 18-karat gold, especially when alloying coin. I would like to be enlightened on this 'trick of the trade.' "

In alloying fine gold (24-karat) or coin gold down to 18-karat, silver and copper should be the only alloys used. The silver should be fine and the copper either purified shot copper or the special wire made for alloying. A pale, ductile and malleable 18-karat is made of fine gold, 18 parts; silver, 4 parts, and copper, 2 parts. If a red alloy is desired simply reverse the amounts of the silver and copper. When using coin gold, which is about 22-karats fine (21 3-5 karats, to be exact), an excellent 18-karat alloy is, gold coin, 19½ parts; silver, 1½ parts, and copper, 3 parts. This is a good ring alloy.

American coin gold consists of 90 parts fine gold to 10 of copper. The French coin is the same. The English gold coin is a trifle finer, being composed of 91.66 parts fine gold to 8.34 parts copper.

When convenient, it is better to use 24-karat or fine gold in the making of alloys, as in the frequent meltings of coin gold the copper oxidizes and burns to a certain extent. However, with care in melting and rolling, 18-karat gold may be gotten out either way.

Always use same crucible in melting, that is, do not use one in which silver solder or other metals have been melted. Put in metal so that gold is last layer. Break a few crumbs of lump sal ammoniac, mix in with pow-

dered willow charcoal and cover the gold well. When melted stir thoroughly with an iron rod, keeping the molten mass under the charcoal layer. Remove from the furnace and let stand until the top of crucible extending down to the gold shows a dark red, almost black, then pour quickly as possible into an ingot which has been previously warmed a little. Eighteen-karat gold is pretty much like silver in melting and pouring; if poured too hot it will spit and rapidly absorb the air.

After removing from the ingot the gold should be well hammered and given two or three *heavy* drafts through the rolls to insure closing of the grain in center of the bar. Many a bar of perfectly melted 18-karat gold has been condemned simply because it was not properly "broken" down in the rolling.

If light drafts are used the surface only is pressed, the grain in the center being stretched, later showing cracks and holes. Eighteen-karat gold should never be annealed after removing from the ingot until it has been well hammered and rolled.

The reason that silver and copper should be the only alloys used is that prepared alloys on the market usually contain zinc in some form or other and burn out or volatilize in gold as high as 18-karat in quality.

CHAPTER XXXVI.

THE BUYING OF STONES.

Assorting Sizes of Melees—Careful Figuring Necessary on Goods in Which only Small Diamonds are Used—Get Your Profit on Goods That are Moving—Stones Sold by the Pennyweight—How Pearls are Sold—Shaped Stones Priced by the Dozen.

THE manufacturer buying diamonds direct from the cutters is often confronted with the rather difficult task of assorting the various sizes and putting them in stock at the prevailing market value. To illustrate, we will presume we have purchased 30 carats of melees (different sizes), and in this paper of diamonds we sort out 12 carats of stones running 64 to the carat, 6 carats averaging 100 to the carat, 5 carats that run about 150 stones to the carat, and the balance in 1-16 carat stones, 1-8 carat, a few 1-32 carat stones, in all weighing together 30 carats. We have bought the lot at $100 per carat. Now, 1-64 carat sizes may be bought for less than $100 a carat, while, on the other hand, the smaller size stones cost to-day anywhere from $125 to $250 per carat.

Figured on these prices, it has happened that the smallest diamonds cost more than those four or more times as large — a stone weighing 1-32 being cheaper than one running 150 stones to the carat. Of course, no customer is going to pay more for a smaller stone, and consequently the smaller stones are figured very close and the profit put on the larger ones. A great deal of judgment must be used, however, as, for instance, where a line of goods is selling in which nothing but small stones are set, and it not always being an easy matter to run across a cheap lot of melee, a paper of stones the exact size desired must be bought, and usually at a greatly advanced price.

In other words, figure your profit on the stones that are moving; the stuff in your safe is practically so much dead wood. As soon as you get the costs figured out, put on ten per cent and put stones in stock.

Semi-precious stones are sold by the pennyweight and also by the dozen. This includes amethyst, topaz, lapis lazuli, coral, turquoise matrix, and other stones of about these grades. Pink and green tourmaline and peridot, with, of course, the rubies, sapphires, emeralds, olivenes, Montana sapphires and turquoise, are, like the diamond, sold by the carat.

Of the reconstructed, scientific stones, the ruby is most in favor. These last stones find ready sale outside of New York. Most likely the exclusive jewelry shops on Fifth avenue persistently refuse to handle the reconstructed stones, fearing it would hurt the sale of the natural article.

In the matter of whole pearls, some stone dealers quote prices per grain base and others show you a paper of pearls at so much a grain. Mr. A. has a lot of pearls for sale at $2.50 per grain base. You select one weighing one and a half grains. Now, to get the price per grain of a pearl weighing one and a half grains, you multiply the cost per grain base ($2.50) by one and a half. This is $3.75. Multiply this by one and a half and you get the cost of a pearl weighing a grain and a half at $2.50 per grain base, which is $5.63. A four-grain pearl, $2 base, is worth 4 x 2 x 4, equals $32. The weight of the pearl multiplied by $2, gives the price per grain, and multiplying this by the number of grains in the pearl gives us the cost of the pearl. Half-pearls from No. 3 to No. 12 are usually sold at prices per one thousand, while the larger sizes are quoted per hundred.

Baroque pearls are usually sold by the grain, the smaller sizes being fractions thereof. For instance, we buy a paper of 1-6 baroques at 18 cents per grain: each pearl costs us 3 cents. The smaller diamonds, whole pearls and half-pearls may be conveniently kept in small bottles; the rubies, sapphires, emeralds, olivenes, etc.,

also in the same way. Have a sheet iron or tin box made in which the bottles stand snugly. The writer colors the corks so that at a glance he can tell which bottle holds sapphires and which rubies, etc.

All stones should be entered in a stone book as soon as bought and given a mark, a letter or a figure. Say we buy ten carats of Montana sapphires from Smith & Co. We enter the lot in the book as ninety or a hundred Montana sapphires, whatever the number is, "Series A," and leave space for subsequent entries as the stones are used. The bottles are likewise labelled "A." Now, when all these stones are used and it becomes necessary to buy more, the next invoice is marked "B," and so on to the end of the alphabet. The next series is started A1, B1, C1, etc., and the next A2, B2, C2, and so on indefinitely.

The semi-precious stones that are sold by the dozen are those that have become more or less staple, as the oval stones for links and scarf pins, and also the square stones used in bar pins. It is a great deal more convenient to figure this stuff by the dozen, and the weight of each individual stone is not so important as in the case of the very precious stones.

Reverting to the beginning of this chapter, I am reminded of a business interview with an ambitious young stone salesman who had a lot of olivenes he was extremely anxious to dispose of. Upon naming his price for the lot, we asked him what he would charge for a selection of some of the sizes. He promptly quoted us a price which was more than he wanted for the entire lot. Upon our venturing to remark that he seemed a little high, he said that he had to ask more for a selection, as the sizes left were not desirable.

NOTE—The figures given here are merely nominal and are intended merely as illustrations showing method of figuring costs. Rapid fluctuations make it inadvisable to use present quotations. See Appendix.

CHAPTER XXXVII.

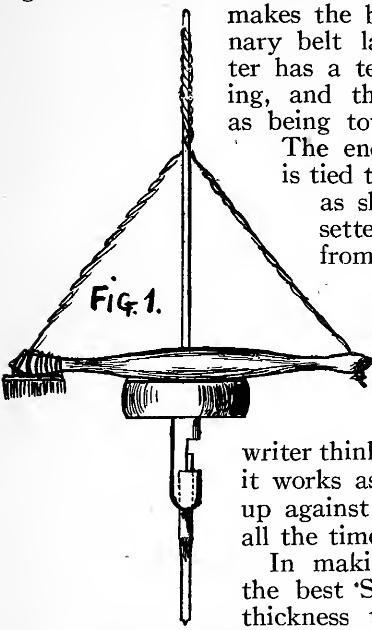
MAKING PEARL JEWELRY.

Preparing the Dies for Saving Stock—Using the Pump Drill—Making the Drills and Beading Tools—Polishing with Emery Paper—Burrs for Claw Work—Half-Pearls in Platinum—Different Alloys Used for Gold Work.

FACTORIES making fine jewelry having half-pearl ornamentation, make it a practice to have the places meant for the pearls struck up in the die. Before the die is sunk the hub is given to the stone setter, with instructions as to the number of pearls it is desired, and size to go in pin. The hub being drilled correctly, it is then hardened and a die sunk from it, when the settings will be clearly indicated in the gold work and will only need a little redrilling to sharpen them up and make a snug receptacle for the pearl. The one disadvantage is that the edges are apt to break off around the pearls every once in a while, necessitating a new die or a softening and resinking of the old one. This is of comparatively little moment, however, and is more than made up in the uniform output of goods, same size pearls and quantity, and also in the saving of the stock, an article with the pearls in the die being raised about one-third thinner than if it were to be drilled afterwards. Half-pearls are mostly set piece work in the large factories, as, in fact, are nearly all stones, some of the shops retaining one or two men to work on special or odd designs at a fixed wage.

In drilling, the pump drill stock is used, as shown in Fig. 1. Some setters use two stocks, a lighter one for cleaning out the holes after the first drilling and cut-

ting has been done. Eel skin or snake skin evenly cut makes the best cord, although ordinary belt lacing is used. This latter has a tendency to keep stretching, and the skin is recommended as being tougher and more lasting.



The end of an old toothbrush is tied to one end of the handle, as shown. This enables the setter to keep his work clean from the drillings without having to pick up a brush every time. As a lubricant, some use turpentine and others swear by soap and water. Personally, the writer thinks the latter is the better; it works as well, and you are not up against the odor of turpentine all the time.

In making the drills, use only the best 'Stubbs' steel and get a thickness that fits the tail stock snugly — not the slightest rock or wabble; this is most important in good work. Learn to file the drills to the various sizes so they will drill absolutely true to center. Of the sizes you will use the most, say from No. 5 to No. 10, make at least a half-dozen of each size. You are bound to have some "pets" among these that will drill better than the others, and when these finally give out, the old timers say it is like losing a friend. Fig. 2 shows how a drill should be filed and ready to insert in drill stock. The cutting edge should be only slightly beveled, and you should make it a rule to have all drills cut on the down stroke, generally when the stock is turning to the right. Try to work with as little a tip or "tit" to drill as possible, so that it will not show on back of the article you are setting. For

hardening, some setters plunge drill, after heating to a cherry red, in beeswax, others use ordinary machine oil, and lots of drills are hardened in water in which a little salt is thrown. They all work about the same in the long run. Before heating, the drill should be stuck in a cake of soap. This protects the steel in the flame and prevents the surface of the drill from getting burnt, and also presents a clean surface ready for tempering after coming out of the hardening bath. Do not blow directly on the point of the drill in heating, but about a half-inch from the end, and as the drill gets red, gradually heat to the end. The drill may now be brightened a little more by rubbing on the oilstone and then held in a gas flame, or over an alcohol lamp, letting the flame strike the middle of the drill until it shows blue and a straw color is spreading to the cutting end. When a pale yellow or straw color shows on the end, plunge at once into oil or water, and the drill is ready for the final sharpening. The end fitting into the stock need not be hard, of course.

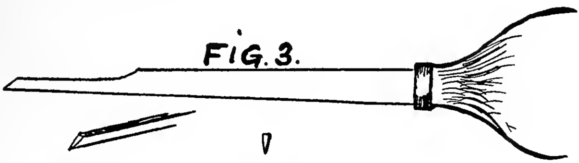
FIG. 2

The usual method in drilling work for pearls is to first drill about three-quarters the depth, then do the bright cutting, then redrill to get the other quarter or full depth. This sharpens up the hole, cleans it out, etc. The bright cutting is done with a graver called a "spit stick," and is a knife-edge cutting tool with the sides slightly rounded, as shown in Fig. 3. The beautiful bright luster is gotten by carefully rubbing the cutting sides and point of tool with the finest emery paper (No. $^4/_0$), after well sharpening on the oilstone. Do not polish too much so as to smooth off the cutting edge and prevent a clean cut. Setters of twenty years ago, and some to-day, use "bort" (diamond dust) mixed with a little alcohol and rubbed on a boxwood block to polish their

gravers, but the finest emery paper does just as well, is cheaper and more convenient to handle.

The beading tools are also made of Stubbs' steel, and are shaped and filed to the size, the bead on the end indicated with a half-round graver and then finished in a beading block, hardened and tempered and well polished by putting in a lathe and pressing the emery paper against the end by means of a piece of wood. The better the tool is polished, the brighter the bead on your work. All stones, other than pearls, that are set close or thread set, are first laid out with a pearl drill and then drilled through with a twist or flange drill slightly smaller, so as to leave a bearing for the stone.

FIG. 3.



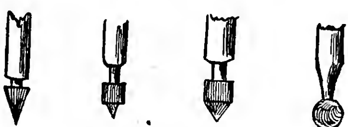


FIG. 4.

In cramp or claw work, where the stones are held by prongs, if a number of stones the same size are to be set, a burr or frazer is made and is put in an upright drill press or lathe. The work is held firmly and is carefully burred out so that the stone will fit in. These burrs may be bought in sets from the jewelers' supply houses, but the writer recommends making your own to fit the job you are working on. A little experience will soon teach you how to go at it. Do not have your cutting edges very deep and use as fine a three-cornered needle file as you can. Get familiar with the drill press—whether it

runs true, with not too much swing or wabble. You might make a burr the exact diameter of the stone to be set, and your lathe not running exactly to center would of course cut a larger hole. Fig. 4 shows some burrs or frazers in use to-day. Excepting the beaded prong on a setting, no gold work should be polished after setting; the workman should send in his work all beautifully bright cut, the scratches or "slips" on side of work (if any) carefully burnished out. The pearls, after putting in the finishing parts, are covered with a paste of powdered carbonate of magnesia and sent to the polishing room for washing out, the putting on of the magnesia preventing any rouge or tripoli from getting in the pearls in the final touching off of the pin tongue rivet, pendant attachment, etc. Magnesia is also painted in as a bed for the pearls before being set. This in a measure keeps out moisture and prolongs the life of the pearl.

Where half-pearls are set in platinum, as is the case in a few of the stores, the mounting is drilled and cut, the pearls fitted and then polished with a special platinum tripoli and rouge before the pearls are fastened in. All stone work, diamonds, sapphires, rubies, etc., of course may be polished after they are set in platinum, the "azures," or holes in the backs, being covered with the magnesia before doing so.

All half-pearl work that is not backed, as stars, sunbursts, fancy scroll pins, etc., is cut out of 170 stock in the dial screw gauge. Articles raised in dies may be gotten out of 120 stock, and goods that are backed up are made out of as low as 60 stock.

Excellent alloys for half-pearl work are: 18-karat — Fine gold, 18 parts; fine silver, 4 parts, and fine copper, 2 parts. 14-karat — Fine gold, 14 parts; fine silver, 7 parts; and fine copper, 3 parts. 10-karat — Fine gold, 10 parts; fine silver, 6 parts; fine copper, 2 parts, and Guinea alloy, 6 parts.

These alloys are all a pale, rich color, and are well adapted for half-pearl work. If they should be desired a trifle more red, simply take off from the silver and

add to the copper so that your totals, 24 in each case, will be the same. It is a good plan to have a piece of brass plate, the exact thickness of your work in hand, to experiment on so as to see if drills are working right, "tit" is short enough, etc.

CHAPTER XXXVIII.

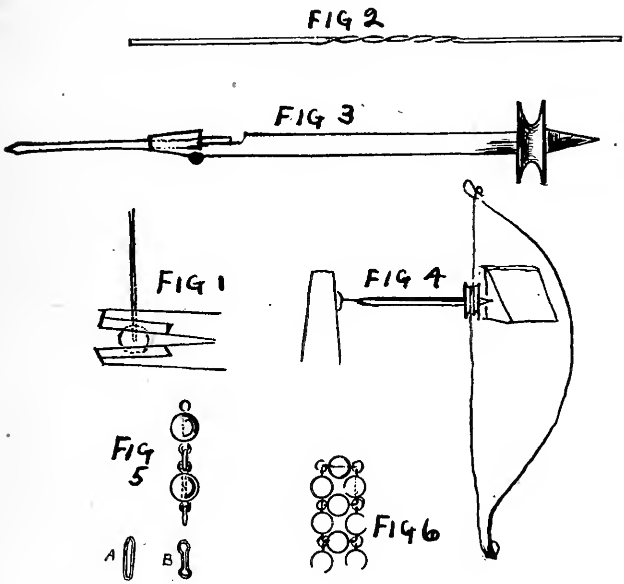
DRILLING PEARLS FOR STRINGING OR CEMENTING.

Special Pliers for Holding the Pearl—Making the Drills—Wider Grooves than in Regular Twist Drills—Bow Drill for Irregular Shapes—Cement Supersedes Wedges in Fastening Pearls on Pegs—Liquid Solutions of Little Use—Riveting not Advised—Making Rope Necklaces.

ROUND or button pearls are drilled for stringing or cementing on pegs by holding them in a pair of pliers especially altered for this purpose. The plier is filed on both sides and a piece of copper or brass is soft-soldered on; cavities are hollowed out just large enough to take the pearl and hold it firmly for drilling without any risk of crushing the pearl. A hole just large enough to admit the drill you are going to use is drilled through one nose or side of the pliers so that it goes through the center of the hollow. (Fig. 1.) The upright drill press is the most practical for drilling pearls, but good work can be done on a horizontal lathe as well. After drilling the plier it should be hardened, as in drilling several pearls the drill will wear the hole larger and the pearl will not be drilled in the center, and, furthermore, unless the drill point strikes the center of the pearl there is risk of splitting it. The large and expensive pearls are drilled by hand, an old-style bow drill being used. This bow drill may be made out of a piece of a rib of an umbrella, or, better yet, a whalebone. Violin string or catgut is the string used. Do not have too great a tension, as the drill wheel will take up some of the slack.

Drills for both the lathe and hand work are specially made, generally by the man who does the drilling. The regular twist drills are too solid, not enough groove in them, as they are made for metal drilling, and while they

are used occasionally, the pearl driller soon finds that a drill made on finer and more delicate lines is what is needed. Now, to make these drills, get a coil of best steel piano wire, the size of the hole desired, and cut off a dozen pieces three inches long. Put one end in a pin



vise and hold over an alcohol lamp so that point of flame touches middle of wire. When red quickly place on a hardened smooth flat steel block and hammer with a smooth-face hammer. When the center section is flattened, say, about three-quarters of an inch, and is about forty points in a dial screw gauge, smooth carefully with fine emery paper, hold again over the lamp and twist; leave the grooves wider than in a regular twist drill. Place again on the flat block and hammer carefully so that the twist will be the same thickness as the shank of

the drill. (Fig. 2.) Finish by drawing the wire through a round hole draw plate. Now file through center and you have two drills ready for hardening. If you have twelve strips, twenty-four drills are now made.

After drawing down (tempering) to a deep straw color, put the shank in a lathe (horizontal) and fit a grooved metal block for the drill to rest in while smoothing and sharpening the spiral with a needle file oilstone. The point of drill is sharpened so that the cutting edge is slightly higher than the general face of the point. Always have plenty of drills; you will find some of them good, doing twice or three times the work of the others. Sometimes out of a couple of dozen drills perhaps only twelve or less are of any real service. This may be the fault of the steel, overheating or burning in the hardening, or not running true in lathe, etc. The writer has fouud it best to chuck out these poor drills at once and make others. When you get a couple of dozen good ones, hang on to them and they will last for years.

A piece of brass hollow wire is drawn over the drill, leaving just enough of the business end to work with. This strengthens the drill and also serves as a gauge in determining depth of hole. Soft solder the brass to the drill at the shank end; enough solder will run in to hold securely.

The ordinary flange or flat drill, filed beveled, the cutting edge also slightly beveled, is used in the bow drill (Figs. 3-4).

Irregular shape or baroque pearls are nearly always drilled by hand in first-class factories. These pearls generally have a better side; the pearl is first marked with a point and is then held in a pair of pliers hollowed out as before, only that no hole is drilled in the pliers. Unless you are drilling thousands of these pearls (in which case the man's bench is fitted up with a power lathe), after marking the place to be drilled, insert the point of drill and use the bow drill, and the job is done. To first mark the pearls and then take the lot to a lathe, means handling each pearl twice and a turning of them over to

find out spot for drilling, the labor consequently being more. Baroque pearls should always have a flat base. Touch off the pearl carefully with a new flat file. This insures against rocking on the peg and prevents a great many pearls from becoming loosened and lost.

Cements of various kinds are used almost exclusively in fastening on the pearls. Some years ago large pearls, especially for studs, were riveted on. This was necessitated by reason of the fact that in those days gum mastic was the only cement used. One way of fastening the pearl was to use a split peg: a tiny wedge was inserted, and as the pearl was gently tapped on, the wedge was driven further in the peg, thereby spreading it, a drill with the point broadened out being previously used. This, when inserted in the pearl, widened the deepest part of the hole. Another method was to use a fine gold or green gold hollow peg with a little shot in the end loose, said shot forcing into the hollow wire with the tapping on of the pearl as before. These pearls, when put on in this manner, were there to stay, and therein lies the trouble, as in later years large numbers of these pearl studs were sent in by private customers to have the pearls removed and mounted into brooches, pins, etc. The only safe way to get out the peg in this case is to drill it out, using a small drill as a starter and finishing with a drill about the size of the peg.

There are now in use specially prepared cements for pearls, of which the best is Wagner's American pearl cement. For some work a French white mastic is liked, and for large pearls of a grain or over white shellac is excellent. There are also on the market liquid solutions for pearls. These are not of much use except in imitation pearls, and ordinary liquid glue will answer for these just as well. To properly fasten on a pearl with cement the hole should be as deep as possible without showing from the front. The peg should be well roughened and "chewed" up, so that the pearl goes on snug. Warm up cement and "string" out to just the thickness. Plug up the hole with cement, heat both the pin and pearl,

and quickly fasten on and hold with tweezers until cool. If you are putting a number of pearls on one pin, gently warm all after final pearl is on, and go over the lot. Sometimes a pearl will "rise" a little in putting on of the others.

In certain work to-day some manufacturers use a platinum peg, drill pearl all way through and rivet the pearl on. This is chiefly done in work where the pearl is put on sideways, the end of the rivet not showing from the front. This practice is not advocated, as the pin or article being discarded, it is hard to adapt the pearls to other jewelry. A pearl with a hole clear through it is not nearly as valuable either.

Whole pearls are used in the making of rope necklaces, two or more strands being used. A very effective and less expensive way is to alternate the strands with onyx beads. These pearls and beads are strung on surgeon's silk and the "ropes" are made by tying the number of strands together at one end, stringing on the pearls or beads, then twisting each strand separately considerably, and finally bringing all together, when the recoil will twist them all into one rope. The ends are securely tied to prevent unfastening or untwisting, and a box and snap cemented on with shellac.

Pearls are strung on platinum or gold wire, making fancy patterns, as Figs. 5 and 6. The wire for stringing is drawn very fine, in the case of platinum especially so, and are wound into narrow oval or flat rings, as A, squeezed through the hole in the pearl and the ends rounded into rings, as B, and jumped together with a connecting ring. The same principle is carried out in Fig. 6. They are made in any number of widths. The loose connecting ring is sometimes not used; in this case the eye wire is linked into the preceding one and soldered, then squeezed through the next pearl, another eye ring fitted in and soldered, and so on. A very tiny flame is used so as not to risk scorching the pearl.

CHAPTER XXXIX.

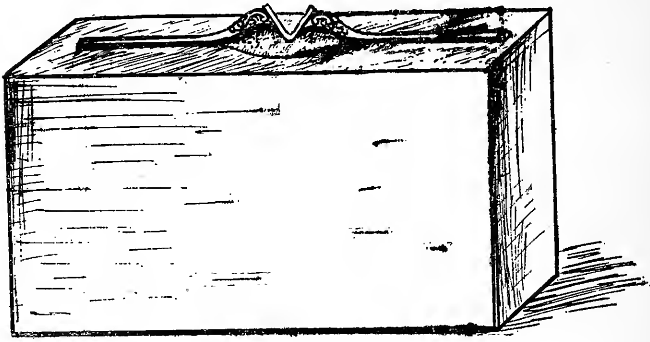
RING MAKING.

An Apparently Inviting Field in Which there is Sharp Competition—Revolution of Methods—Labor-Saving Devices and Modern Machines a Necessary Feature—Dies and Press Work for Ornaments—18-Karat Settings on Lower Grade Shanks.

THERE is no branch of jewelry manufacturing that has been revolutionized more in the past twenty years than the making of rings. An inviting field to enter, by reason of the enormous output and the constant demand, manufacturers have gone exclusively into this line, discontinuing all else; hundreds of ring shops have sprung up all over the country, since, excepting in the case of the fine platinum goods, fancy special and carved work, rings can be made by low-priced labor. There being little opportunity for getting out anything distinctly new and original, under sharp competition, the makers have been forced to devote all their thought to labor-saving devices, installing machinery and tools to facilitate quick production.

Thirty years ago the writer worked in a New York factory and remembers the methods then in vogue —rolling down a bar through the half-round rolls, cutting into different lengths, rounding on the ring shaper, soldering, rounding on the mandrel, the subsequent turning or truing on the lathe, and the final polishing of the wedding ring. Shanks of fancy rings were all struck in two halves, soldered, shaped up, and the setting or box, or whatever it might be, was let in. Some rings are made this way to-day by small concerns, but the firms making the one-piece wedding ring, cutting or punching it out of a piece of stock and swedging it up in very few operations, get the business.

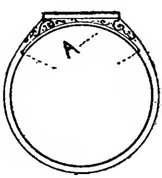
FIG 1.

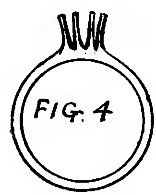


In getting out fancy rings of all kinds, signets, clusters, in fact, all combinations of stones, the main feature to keep in view is the getting of the top, or ornament, out as cheaply as possible by means of dies and presswork. Fig. 1 shows the hub of a plain signet. This, of course, is sunk in a die and a dummy or half-hollow force is reduced to strike up stock. A blank is cut out, slightly thicker than the shank is to be when finished, struck

FIG 3

Fig. 2





in the die, passed through the cutter for trimming, shaped up, and a lining let in under the top, extending

under the shoulders of the shank. See Fig. 2. This is soldered and filed up carefully. It might be added that a notch is filed in some instances on the inside of the signet before bending flat and shaping up, so as to avoid straining the gold and showing "frets," or seams, across the top.

While the best, or at least the highest priced, Tiffany rings are still made all in one piece, being hammered and filed out of a thick piece of stock, an excellent ring is made as in Fig. 3. The stock in this case is cut somewhat thinner than the head, or the thickest part, and after

FIG 5

FIG 6

FIG 7

being removed from the drop hammer, the gold will have been forced up into the deepest part, or shoulder, of the shank. Always find out, before striking up any big jobs, just how thin you can roll your stock, and act accordingly. Shape up shank, get exact size wanted, have a burr or frazer just the size and slant of setting you propose soldering in, burr out clean, so that setting fits snugly, and solder with best quality solder. Some firms use, in an all-gold ring, 18-karat settings, regardless of

what the karat quality of the shank may be. This lessens the danger of burning or melting the points, and

Fig 8

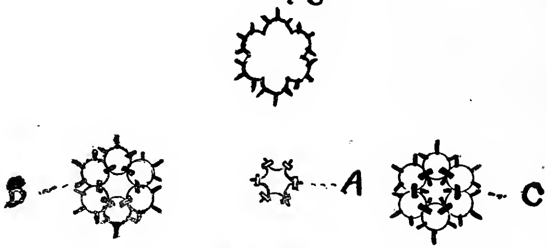


Fig 9

after setting, the prongs take a much better and more lasting bright cut. Fig. 5 may be struck hollow or solid, as desired. The hole for the stone is drilled after ring is shaped up and soldered. Fig. 6 is made from the same die, the hole being drilled before the ring is rounded, thus forming an oval setting.

A style of ring shank is shown in Fig. 7 that is capable of any number of combinations of settings. It can be adjusted to a round, cushion shape, oval or square stone with equal facility, or a round or oval blank may be soldered on the top as a signet. Staple patterns in cluster rings, both round and oval, or "Marquise," and also the "Princess," are made by cutting out the outside wall or outline, and soldering in the inside sections. In Fig. 8, A is soldered in, as at B, with a single setting in the center, as at C. When complete with shank and stones, we have a finished cluster ring like Fig. 9. The little oblong prong in A is split by the stonesetter, each half thereby becoming a prong. With these ideas furnished, the jeweler can branch out into an endless number of de-

signs. Where more trimming is wanted, always try to get it out in the die.

The getting out of the signet, as at Fig. 1, enables us to get an undercut. For heavy, elaborate and jeweled rings of intricate design, sectional dies are made. The sale of such goods is obviously confined to a few stores, and it is doubtful if the cost of the dies is ever gotten out of these expensive patterns.

CHAPTER XL.

SIZING AND SOLDERING OF RINGS.

A Frequent Item in the Jewelry Repair Department—Sawing a Ring from the Finger—Finding the Length of Added Piece—Some Wrong Ways of Fitting—Cut Out Sections Previously Repaired.

WHILE the soldering and sizing of rings has been touched upon in a previous chapter, yet upon noting some queries in various trade papers the writer will go more into detail, and also endeavor to add more information about this, probably the most frequent item in the jewelry repair department.

The jeweler is called upon to take a ring off a finger, and the ordinary methods failing, it has to be sawn through and spread open to slip off. It is a notorious fact that some storekeepers have been known to spend a half-hour or more fiddling with a needle file (oftentimes a larger one), rasping off the skin, and otherwise making it uncomfortable for the customer.

A ring may be removed in a few moments without trouble if lifted, by means of two pieces of wood, from the flesh, the saw blade inserted, secured to its frame (rather slack), and the sawing done carefully. If the ring is a thick, heavy one, it is sawn in two halves; better to do this than to take any chances of mutilating the flesh by trying to open with pliers or other tools. Thin, narrow bands are sometimes removed by cutting with cutting nippers. This is more or less risky and does not make as clean a job for letting in of a piece for enlarging the ring. When you start to use the saw, explain to your customer the method of procedure and you will allay much unnecessary nervousness, especially in the case of children.

All ring sticks have a gauge marked to show the length a piece of metal should be to make a ring size 5, 6, etc., and also how much gold to add to make a number 6 ring size up to number 8, and so on. The rule is to mark off the length of the piece and add the thickness of the gold extra. This last is not so important in thin rings, but in thicker shanks it will be found an item.

Another way to find out is to open up the ring to the right size, place on a ring stick and fit in the piece of gold. Where possible, tie not too tightly together with iron bending wire. If a ring, after soldering, does not quite reach the desired size it may be enlarged by placing on a steel mandrel and gently tapping with a hammer. Do not tap the solder joints.

The mandrel, by the way, should be of hardened tempered steel and the apprentice boy instructed not to fill it full of dents or nicks. The hammer should be of slightly softer steel to preclude this happening, which will save a lot of labor in refinishing rings. All joints to be soldered should just touch and no more. If the ends of a ring spring together, they will overlap or open out in the heating. Examine a ring well to find the joint before sawing through, and if in doubt anneal black, when seam will show. If a ring shows signs of having been soldered in a number of places, or a section is plastered with solder, you will find it much cheaper to cut out that section and replace with a new piece of gold. It does not pay, after you have carefully fitted a piece, to have half the shank tumble down like a stack of cards in the soldering.

Heavy rings are opened for enlarging by forcing on steel mandrel and hammered with a rawhide mallet. Tissue paper made by folding up strips about a half-inch wide, of a dozen thicknesses, is the quickest, best and most practical covering for stones. The expert ring sizer will have half a dozen of these strips lying at his place in a shallow dish or plate, with just enough water to keep them wet, and taking the rings as they run, will size a dozen an hour. The paper is neatly and quickly wrapped around stones, well pressed down and held with

spring tweezers. Care must be taken to see that paper does not open from ring in soldering. It is well to drop a little water on to paper just before soldering to insure a thorough wetting.

Asbestos string is sometimes used, but this is unnecessary if directions are carefully followed out. Use a large flame, plenty of gas, and solder as rapidly as possible. If necessary to stop and add solder after the ring has been heated, it is advisable to examine paper and drop a little more water on if needed.

CHAPTER XLI.

CHAIN MAKING.

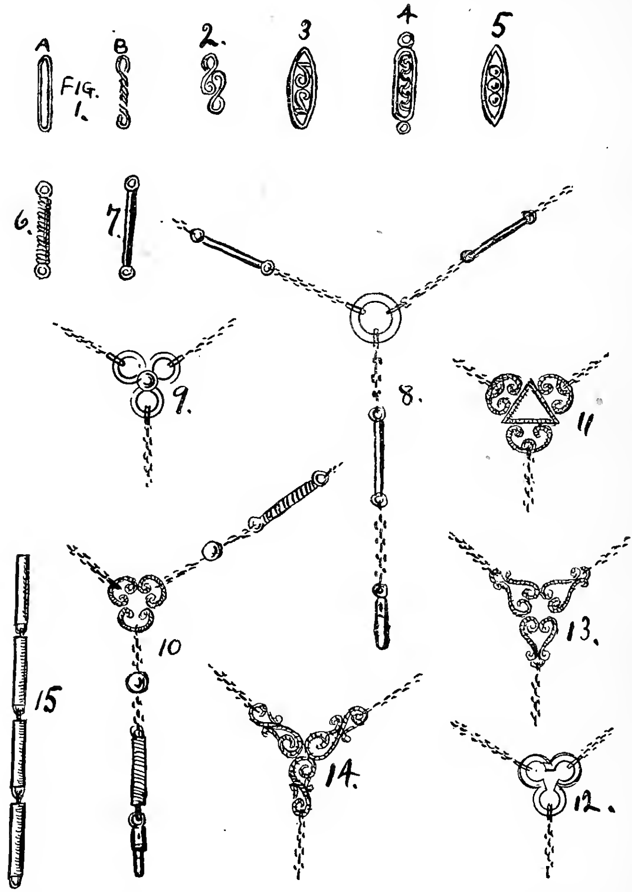
Machine Work on a Large Scale—Cutting Up for Special Patterns—The Popular Sautoir—Finishing in Roman—Linking Up Rope—Making Links for Enameling—Inserting Pearls.

LARGE manufacturing concerns in Providence and the Attleboros have gone into the making of chain on a large scale, installing machinery and specially training their employees for this branch of the jewelry business, thereby reducing the cost of production to a point considerably less than it is possible for the average maker of jewelry to turn out cable, rope, horseshoe or corn chain, foxtail or other patterns.

These chains, especially the cable pattern, are bought from the chain makers in about 100 foot lengths, and are cut up by the manufacturers of pendants, lavallieres, fancy drop necklaces, festoons, etc. A little touch of originality is given by the insertion at intervals of a hand-made ornamental link. This stamps a sort of individuality on the goods, and a demand is often created for a simple cable neck chain which has half a dozen little gold or enamel ornamental links let in at equal spaces.

In buying the cable chain it is best to get the kind that has separate soldered links. The chain that is linked and soldered in links of two together at the joint is good enough for long pieces, but where you are cutting up the chain it is ovbious that there will be a waste. It is quite within the scope of the average shop jeweler to take this chain and insert a few little links of his own making and turn out a dainty little neck chain.

A few patterns are here shown of simple but effective design, very easily made. Fig. 1 is very fine round wire



wound on a flat arbor which is rounded on the edges, the links soldered and twisted as shown at B. Fig. 2 is two scrolls soldered together. Fig. 3 shows a couple of

scrolls soldered in a pointed oval ring; Fig. 4 is a half-ring in a frame; Fig. 5 consists of rings with a shot center; Fig. 6 is a coil soldered stiff, with connecting rings soldered on each end, and Fig. 7 is a plain, smooth, round wire. There are a number of fancy wire draw plates which furnish an infinite variety of patterns; some of these may also be made by drawing up round wire to the desired thickness, cutting into suitable lengths and soldering together in threes or fours, making the corrugated or ribbed link.

Another touch of character is given to the neck chain by making the front a little different, altering it so that a little drop or piece of chain suspends from the neck-piece. This in one jump raises the title of the heretofore modest necklace to that of "sautoir."

Incidentally, the "sautoir" will sell at a somewhat higher price and out of proportion to the slight increase in cost of making. Fig. 8 may be made out of either round or flat stock. The flat is a little disc with the center cut out in the press, which, when lapped and finished bright, shows up well. Figs. 9 and 12 are three round wire rings connected, the first having a stone or pearl in the center. Figs. 10, 11, 13 and 14 are little screw-edge scrolls and look best finished Roman color.

In finishing these in Roman the work is stripped in the solution after soldering, well scratch-brushed with a steel brush, and put into the gilding solution without any further polishing. This will produce a bright Roman, not unlike acid coloring. These are all simple designs and are here shown as suggestions to the reader who may wish to make up a few fancy drop "necks" or sautoir effects for his stock. The spring rings and swivels may be purchased from several good makers.

The Newark factories still make a great deal of rope chain in its various sizes. The links in some instances are made in Providence and sent on to Newark for linking, charging and soldering. Girls, after a few months, become expert in linking up this very ornate and graceful chain, an expert linker making as much as seven feet a

day, which, considering there are some 85 links to the inch, is "going some." The girls work in groups or teams, each team having a foreman who stiffens the chain with iron binding wire, charges on the minute pellets of solder and "blows" it off. This is a tedious job. Every second link only is soldered, as otherwise a stiff chain would be the result. The corn chain is made of round links closely linked and soldered. The foxtail is machine-made. A curb chain is made by linking up the regular cable chain, fastening one end into a bench vise, holding the loose end with a pair of pliers and twisting. A close curb is made by winding the rings on an oval arbor just large enough diameter so that after sawing the links apart they will just link up, with no loose motion. After curbing you will have a fine close curb.

In making links for enameling the hollow wire is best. Fig. 15 shows a piece of enameled chain made of hollow wire drawn up out of 60 stock in dial screw gauge. The seam is soldered and then drawn down to the desired thickness, sawed off into lengths and little washers or caps soldered on the ends; or, better yet, strips are turned off in a high-speed lathe, leaving little edges on each end as a stop line for the enamel. This last is by all means the best, as no solder is applied, and a sharper, cleaner stop line is obtained.

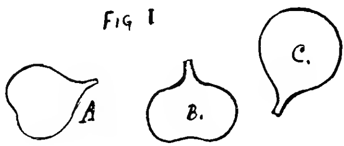
A silky effect is given to transparent enamel by grooving the link with a lining graver while in the lathe. Other effects are secured by engine turning or by "wriggling" with a flat bottom graver. Pearls are let in chain to enhance the beauty of a necklace; an inexpensive method of attaching them is to run a wire through, bend an eye on each end and twist a little of the wire to prevent its pulling out. Another and better way for larger pearls is to run a hollow wire through, having ring on one end and tapped on the other for a screw wire which is screwed in, this having a connecting ring on its end also. To prevent it from unscrewing easily, heat and put in a little pearl cement or gum mastic.

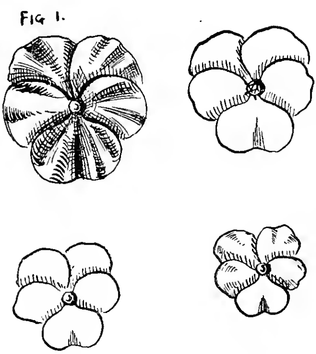
CHAPTER XLII.

MAKING FLOWER WORK.

Flower Designs are Always Staple—Few Tools Necessary for Successful Competition—Details of the Pansy—Making the Plaster Form—To Soften Modeling Wax—Setting Up for Enameling—Cheaper to Buy Findings than to Make Them—Good Work for Apprentices.

CERTAIN designs or patterns in jewelry will always be staple, and of these none will endure longer than flower work. There is always a sentiment, real or fancied, in connection with the gift or purchase of a piece of jewelry of which a pansy, clover, violet or other flower forms the design. Aside from this, a flower pin is a most practical article, as it may be enameled to match the one blooming in the garden, black for mourning, or the various tints and shades of purple to lavender, and finally may be made Roman or rose color. The average flower pin is an inexpensive design in the making, and the value shows up well, as the work on the back is very little.



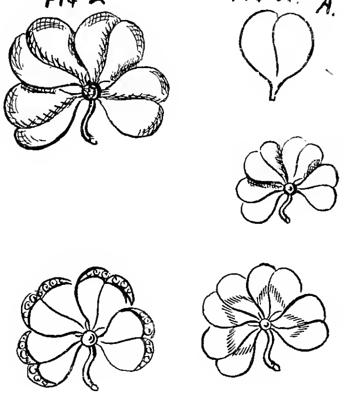


As is well known, all manufacturing jewelers making brooches, scarf pins, earrings, etc., make flower jewelry and are equipped with all known labor-saving

devices; nevertheless, it need not deter the jeweler who has only a pair of flat rolls and a melting furnace from making this line of goods and competing successfully. There are any number of shops making the finest of goods to-day which for lack of space or other reasons make all hand work. Some of the finest models of the English double violet are sawed out by hand. The writer gives here some practical tips on the making of flower work.

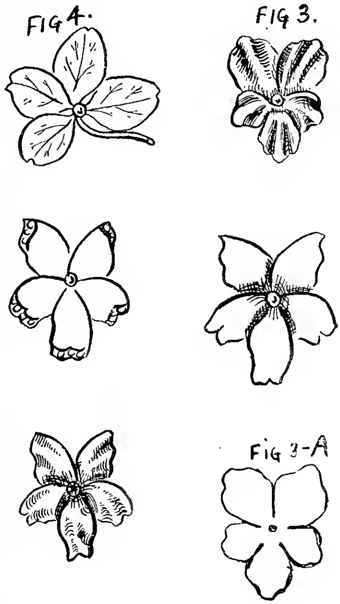
Taking up the making of a pansy, we look at design No. 1, shown herewith. This is five separate petals soldered together in a plaster of paris form. The design is first transferred onto brass and the petals sawed out. Three shapes only are needed, as the four top petals are rights and lefts. The brass should be rolled a little hard, about 60 points thick, in the dial screw gauge; after you get them out a second set of brasses should be cut out, annealed and dapped up to shape. This second pansy is set up on jewelers' modeling or impression wax, and a collar of brass or sheet iron fitted around it; after oiling the brass pieces, plaster paris, mixed rather thin with water, is poured in and allowed to become hard. After about an hour the plaster will have hardened, when it can easily be removed from the wax. It is then placed in an oven or an annealing furnace and baked. The brass form is then removed, boiled out in pickle and placed back in the form and soldered together. It is then braced and carefully put away to be kept as a reference and for the making of new plaster forms. A large form may

FIG 2 FIG 2. A.



be made stiffer by laying pieces of iron wire in the liquid plaster after it is poured over the pattern. A little salt is sometimes mixed in to make it harden quicker. The modeling wax purchased from the material houses is usually a little hard. It is made softer and more pliable by the addition of a little lard while in a melted state in a ladle or saucepan. Be very sparing in adding the lard: a quarter of a teaspoonful will go a great way.

When your brass pattern is judged to be correct and the flat pieces are trimmed up as per any changes, you are ready to make any number of pins of this size. Any size can be made by simply keeping the petals the same proportionate size. For instance, a size larger pin is made by sawing each petal out about 1-16″ wider all round. The petals are dapped up to shape in a lead cake. Get a thick piece of lead from your plumber, or melt a lot of scrap in a ladle and pour into an old iron pot which has been slightly oiled. The steel punches are made from various thicknesses of rods purchased from the hardware store. A set of graduated ball punches is very useful. The knife edge, or other shapes, may be filed up as occasion requires. To get the sharp vein, as in the center of the petals of the clover, a copper or brass block is used. The impression is hammered in to a certain extent by the punch and



additional modeling given to the block by carefully cutting out with gravers.

For enamel work the stock used is 75 points in dial screw gauge, and in those designs showing a stone edge or border the stone strips soldered on are 50 points thick. Sometimes, as in the case of a large pansy, it is advisable to use stock thick enough for setting in the first place. In this case 120 points will be all right; the stone setter "lays" out the edge for the size pearls or stones to be set, then it goes to the engraver, who cuts away the center, lowering the surface about 40 points for enameling. Roman, variegated gold, or rose finished pins may be safely cut out of 60-point stock. The petals are first soldered together, then wire braces connecting each petal are applied. The center at the back is filed flat and a ring or collet soldered to give strength and to act as recess for the setting. Where a pearl is to be pegged on, a peg may be soldered right in the center. The strip "bridge" for the joint and catch is a piece of the same wire as the braces, rolled flat and soldered across at a slight angle.

The joints, catches, pin tongues, settings, etc., are purchased from the makers of jewelers' findings, and unless one is using thousands of these it is cheaper to buy than make them yourself, as a number of tools are used in making these parts, and repairs are often necessary. The cost of purchase over the gold account is a mere trifle.

In sawing out petals always leave the stem a little long, as it will shorten somewhat in the dapping up. A good rule to remember is that you can always take off, whereas it is not so easy or economical to put on. Sometimes it has been found hard to get work for the apprentice boys. After they have learned to solder, give them a piece of silver and the brass patterns and let them saw out and dap up these flowers. It will be of great interest to them and is excellent training and experience. Silver jewelry to-day is enameled in all colors, also finished in all styles of color, from the Roman to the antique. They will make either pins or hat pins and are staple stock.

The clover styles of Fig. 2 are simply made by soldering four of the same size petals together. You will notice Fig. 4 is made of different sizes. The neatest violet is made out of five separate petals, although a skillful jeweler can get it out of one piece, as in Fig. 3. This is sawed out as shown at Fig. 3-A, dapped (after the petals are twisted a little) well in center with a small ball punch.

CHAPTER XLIII.

MAKING A LINE OF PINS.

Under Various Names a Most Useful Article of Jewelry—Always Find Ready Sale—Many Styles, Plain and with Stone Settings, Made by Thousands—A Few Good Sellers—Details of Manufacture.

THE elongated pins, under their various titles—bib, handy, waist, collar, dress, belt, girdle, veil, and automobile pins—are, in conjunction with the collar button and links, the most useful article of jewelry made to-day; anything new and strikingly original will always find a ready sale. In connection with this article, the writer has sketched a few of the most popular sellers for the past few years.

Fig. 1 is the plain pin, which is raised in the die out of as thin as 30 stock, dial screw gauge, for plain gold finish, or of 40 stock for enameling. The better shops solder on a back, thus giving the appearance of a solid pin. The 10-karat houses usually strike up the front with a high edge or "wall," which is carefully filed on the extreme edge so as to turn over in the curling tools. Two sets of dies are used, one plain for gold finish,

FIG. 1.

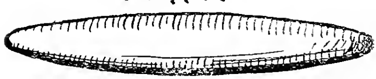
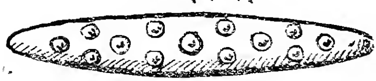


FIG. 2.

FIG. 3.



and the other with a stop line for enameling. Where the jeweler does not contemplate making a big line of these pins, these two dies (for this length pin) will suffice in raising the plain blanks for pearl or stone ornamentation, for engraving, etc.

FIG. 4.

FIG. 5.

Fig. 2 shows a narrow, pointed style, with a pearl strip, 50 points thick soldered on,—on the front outside, if for enameling, and inside the pin, if for plain Roman.

In Fig. 3 the pearls are set in little caps, which are cut out and soldered on. In the case of enameling, the best quality of solder must be used and the caps dapped up to fit the surface thoroughly and snugly before soldering.

Shops making these pins by the thousands, in all the various combinations of pearl trimming, colors of enamel, and in sizes from ¾ inch to 3 inches or longer, have dies for nearly every style. This, it will be noted, is a most expensive undertaking, and would certainly not pay unless the output was large.

In setting pearls, as in Fig. 2, do not use any smaller than No. 5 half-pearls, as those smaller than this size invariably turn black quickly. It is much better to raise gold beads. In Fig. 3 a number 8 or 9 half-pearl is a good size, although smaller may be used, as in a shorter pin it is advisable to have the center pearl a size larger. Fig. 4 shows a spray of leaves soldered on to a frame. The stone boxes in all the regular staple sizes may be purchased from setting makers much cheaper than the smaller shops can make them. The leaves are cut out, and may be bought also.

Fig 5 is another popular pin. These pins in the 2-inch length are belt pins. They are made from about 1⅛ inches long up to five inches, which is the veil or auto pin. The leaf or ornament is set with pearls, diamonds or other stones, or enameled in the various opaque or transparent colors. Of the stones, the amethyst is the most popular and inexpensive. The Montana sapphire probably comes next. All kinds of stones are used, however.

FIG. 6.

FIG. 7.

FIG. 8.

FIG. 9.

FIG. 10.

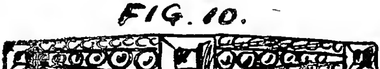


Fig. 6 shows a blunt or square end pin set with three square-cut stones and pearl paved. This style will admit of a great many combinations and lengths, the best seller being a set of pins in which a veil pin 2½ inches long, a belt pin 2 inches, and two handy pins an inch and a quarter each are used. In making this style, first take a piece of gold 170 points thick and fit in your square stones so that they rest just on the edge, then solder a bezel around the outside, of about 40 stock, filing the bezel flush with the thick, flat piece where the pearls are to be set, and letting the bezel stick up to be pushed over

the cut stones by the setter. Leave a little wider than the width of the stone so that the setter can have some stock to wrap around the corners. The bezel should be deep enough so as to project from the back about as much as is left on the front. This applies to all work of this nature, crosses, etc.

In Fig. 7 a thick knife-edge or three-cornered wire is used. The settings are let in and well soldered, then pearl pegs applied between; the bar is then sawed out in the settings, a joint and catch soldered on, and the pin is made. In order to make a pin that will fit snugly to dress, not stick up too high or "flop" over, the bar is filed three-cornered out of square wire and the settings let in as low as is possible. This style of pin is easy for a modest little shop to make, as the setting, pearl caps, joints and catches and pin tongues may be bought about as cheap as any ordinary manufacturer can make them.

Fig. 8 is made as Fig. 6, with a row of square stones set in a bezel down the center. Fig. 9 is a frame with the bars soldered across for stones, or cut for enamel, leaving just enough space between for the square stone, which is held in by four clamps that are soldered on. The bars should project over the edge of the frame so that when the clamps are applied the outside edge may be trued up flush with a file. This is a very effective pin and will admit of any number of lengths or combinations.

In Fig. 10 the pearl center is cut out so that a pearl peg wire may be let in for a tapered row of whole pearls. In making this kind of pin bear in mind that the square-cut stones must be let in as far as possible so as to bring up the half-pearls to as near a level as the girdle of the stones. In Fig. 10 particularly, the whole pearl center is let down well, or the pearls in the outside strips and the square stones (particularly the center one) will present a sunken appearance.

In making pins for enamel, as in Figs. 1, 2, 3, the joint is kept at least from one-eighth to three-sixteenths of an inch from the tip so as to avoid chipping of the enamel

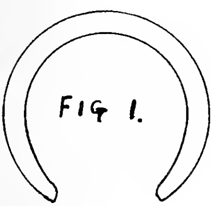
in the pinning up. Of course, in the longer pins the distance may be more. It may be of interest to know that during the rush on the "merry widow" pins, from fifteen hundred to two thousand of them were made every day for several months by the creator of this pattern in 14-karat stock. As before stated, the bib or belt pin is regarded as a necessary article, and the man who comes along with something attractive and reasonable in cost will get business.

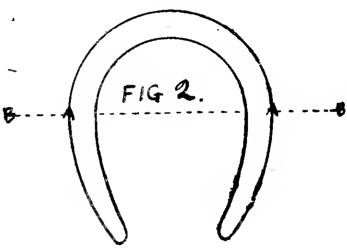
CHAPTER XLIV.

HORSESHOE JEWELRY.

Points on Making This Popular Pattern—Two General Outlines Used—Good Luck Emblems in Black—Solid Stock vs. Hollow Work—Cutting Out Blanks—Must be Absolutely True—Wire Work—Setting with Pearls.

THE horseshoe motif in the making of jewelry is more popularly known than that of any other design. Though the passing of the horse to a certain extent and the stringent laws with reference to betting at the race tracks have somewhat lessened the interest in horse jewelry in general, yet the shoe will always be a ready seller, by reason of its graceful simplicity of outline, the practical uses in applying other ornamentation, as flowers, sunbursts, or other fancy centers, and, above all, the sentimental tradition of its bringing good luck to its wearer. No jewelry store would be





considered as having a complete stock that did not carry at least a half-dozen patterns of horseshoes.

In the manufacture of shoes, two outlines, as shown in Fig. 1 and Fig. 2, are used. Fig. 1 is a perfect circle on the outside, the inner line nearly so, slightly tapering to the outer line at the ends. Fig. 2 is called the egg-shape

shoe, and is probably the most generally used. This is made by first describing two half-circles to the dotted line, then continuing the lines on down by using A A as centers to describe each opposite outside line, and B B as centers for the inside edge. These two outlines of shoes of course are altered to suit the individual; some like Fig. 1 just a little off the round, while others prefer Fig. 2 rounded just a trifle more, or the ends not quite so long, etc.

Shoes, as we know, are made in all sizes, styles and ornamentation, even being made in black enamel, both plain and set with diamonds, pearls, or other gems, these finding ready sale as mourning jewelry in the finest stores. The writer has never quite figured it out whether these black shoes are worn as emblems of good luck at the departure of the deceased, or as a hope of making another lucky catch. We felt the limit had sometimes been reached when customers would order the joint and catch put on the reverse way in having black shoes made to order, so the points would stick up to keep the luck from "running out." However, we digress somewhat.

It has been and is a matter of question, with makers of shoes as well as other work, whether it is cheaper in the long run to raise work hollow out of thinnest possible stock, soldering on backs, or to raise the article solid. In the writer's opinion, the larger sizes should be raised hollow for plain gold, or where nails or stone pieces are to be afterwards applied, but advises that all scarf pin sizes be raised solid. The few cents' worth of extra gold is more than offset by the labor in making hollow pieces, the breaking of forces, etc. Pins one and one-half inches in diameter are raised out of 40-point stock in dial screw gauge. In any smaller size for enameling this gauge should be used, or thicker for large sizes. As thin as 20 points may be used for plain gold, while 30 points is about the average thickness for scarf pins.

The plain blanks for setting, or paving all over with half-pearls, are cut out with two sets of cutters. The outline is first cut out, the cutters changed and the blank

placed in the press on a cutter having a gauge plate screwed on the face bearing the outline of the shoe. The blank fitting snugly in this, the center is now cut out and the shoe is ready for soldering on joint and catch or pin stem. Any thickness of stock may be cut out with two sets of cutters. Certain small hollow sizes of very thin stock may be cut out by making one cutter. About the thinnest stock used for pearl setting, unless reinforced on back by wire or other trimming, is 155 points. That used for small brooch sizes begins at 170 points, running up as high as 300 points in extreme sizes.

An excellent 14-karat stock for pearl pavé is: Fine gold, 14 parts; fine silver, 7 parts; shot copper, 3 parts. A fine 10-karat is composed of: Fine gold, 10 parts; silver, 6 parts; Guinea alloy, 6 parts; copper, 2 parts.

In sawing out shoes first cut a pattern out of hard brass of about 60 points thickness. If the pattern is traced on from design, true it up with dividers before sawing out. A firm may not find it pays to make dies and tools for certain extreme sizes; a brass pattern may be used for years if kept properly. In marking on the gold from the brass pattern leave the gold black from the annealing furnace, as the outline can be seen much better; no matter how true your brass may be, go over the gold outline also with your dividers. There is many a shoe sawn out with "shoulders" or points. The marking point may not always be held at the same angle in going round the brass form and a hump sticks out here or there. A shoe is nothing if not absolutely true. Also learn to train the eye in accuracy. Do not depend altogether on tools.

Wire or knife-edge work is bent and annealed on sheet iron forms. These sheet irons should be drilled all over as much as possible to facilitate heating and also as a means of tying on the iron binding wire. The twist wire pins, as wire bent in rope form around whole pearls or settings for stones are called, are bent or braided over steel pins securely fastened on a sheet iron plate. This plate in turn is secured to a wooden block which may be

held in vise. After the pin is shaped, unscrew from the wooden block and anneal on the form. When cool remove the pin from the form and the shape will be retained.

Whole pearl shoes, where pearls are of one size, may be made by using a regular peg gallery strengthened by fitting it over round hollow wire with the seam opened enough to let in gallery, which is soldered to the hollow wire at base of pegs. The wire is first cut the right width, drawn over copper, bent to exact shape and the copper eaten out in a solution of equal parts nitric acid C. P. and water. In 10-karat work use one-third acid to two-thirds water. In small work where hollow wire is not large, the piece may be soldered on straight and afterwards bent into shoe shape.

Another way of making whole pearl shoes, especially where the pearls graduate in size, is to bend up a solid piece of square wire, mark on spaces and drill about half-way through, or just enough to stick in peg for soldering. A great many jewelers make the mistake of drilling all the way through, trusting to the soldering to fill up and make a good job. As a matter of fact, pin holes develop, or the solder shows so the job is generally unsatisfactory. The round peg wire being forced in the hole it oftentimes happens some of the pegs drop out, the solder not having flushed through, and this does not show until the pin has been polished, pinned up and perhaps a number of the pearls already cemented on.

As before remarked, the hole should extend about half-way through and *square* peg wire used, for the reason that a little space will be left at the hole for the solder to run in and take hold. Another good reason for using square wire is that it may be twisted, thus affording extra clutch for the pearl and cement. After drilling, the pin should be well annealed and boiled out in pickle to remove all traces of oil or grease.

One house making whole pearl jewelry does not drill for pegs at all, simply standing the pegs on the frame by using gum tragacanth mixed up with the borax. This is

a quick way, but does not make as good a job as drilling, as, the hole being slightly countersunk, the pearl fits more snugly into the frame.

In soldering on joint and catch be sure to solder enough above center of gravity so that pin will not "rock" or be "top heavy" while being worn.

CHAPTER XLV.

THE MALTESE CROSS IN EMBLEMS.

A Sure Way to Get Results—A Popular Shape in Badge Work—Perfectly True Form the First Requisite—Flattening the Plates—Cast Pieces for Heavy Work.

DO you know how to make a Maltese cross? No? Why, just pull its tail. This merry quip has seen active service for a great many years, and will undoubtedly be pulled off for a number of years to come in the emblem shops. As is well known, in Masonic jewelry the Maltese cross is used extensively, and the shape, with its possible modifications, is the motif in a great deal of badge work. To make a mounted or hollow cross get a piece of sheet iron about the thickness of a half-dollar, file two sides at right angles, using a steel square to true up with. Then mark off the other two sides with the dividers, saw out and file a perfect square. Everything depends on the iron form being absolutely true; a cross is nothing if not true.

Presuming we are making a one-inch diameter cross, the form is made a little smaller to allow for thickness of stock, which should be about 40 points dial screw gauge. See that edges of the form are vertical and file off corners so as to permit soldering with less heat. The iron form is drilled full of holes for the same reason and also for convenience in tying on iron binding wire. See Fig. 1.

In preparing the bezel stock as shown in Fig. 2, round wire is rolled flat or strips may be cut off in rotary or regular hand shears. The jointing should be carefully made so that the bezel does not shift or fall over in subsequent

soldering on of the back and front plates. The strips are left a little long; first tie on one strip, then shove next up against it and so on. Use hardest possible solder. Having gotten our frame properly made, boil out in pickle

Fig. 1

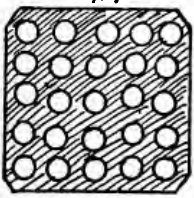
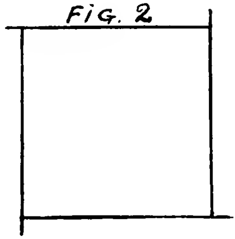


Fig. 2



and solder on to plate, using an easier solder. The arms or corners are made of the same stock as the bezel and are shaped up on the end of an old file, which is filed to desired width and nicked in the end. This file is also used as a force, if sharper angles are wanted, by filing out a slot in a steel block.

Fig. 3 shows how the inside is cross-lined and circled to get the corners absolutely in line and to same point in center. Posts, hollow wire, or other stiffening supports are also soldered in center to keep both sides flat and prevent a sagging or sinking in at the center. The plate is sawn out if onyx is to be fitted in, or other openwork is wanted. At all events, be sure to saw out plate in corners before soldering on back plate. After applying this plate and making sure the seam is well soldered, the cross is carefully filed up, as in Fig. 4. Keep the arms narrow or you will have too much open space and not enough cross.

Machinery is now used in factories making these goods in rolled plate, etc., whereby the frame is made complete in one piece, but the 14-karat shops, by reason of the numerous individual orders as to sizes, still continue to

make everything by hand. The front and back plates are made of fairly thin stock from 35 to 40 points, and are made perfectly flat before soldering to the bezel. This is done by getting two plates of steel with one surface flat

FIG. 3

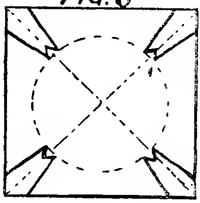
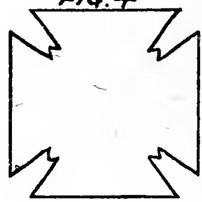


FIG. 4



and smooth, and laying gold plates in between brass or copper outside plates, to prevent possible scales burning on the gold. Then place the steel plates outside of all, firmly bind with heavy iron wire and anneal red (dull). Remove and squeeze in a vise while still hot.

Heavier gold plates are flattened between red-hot steel blocks. The plates are laid on one block, as many as will cover it at a time, and the other red-hot die or block placed on top. In a moment or two the plates will be red hot, when gently tap with a hammer, lift off the die, remove plates, and place others on. A number of pieces may be flattened before the dies cool off, when, of course, they are reheated. The dies should never be allowed to get too hot, as gold is apt to be melted or burnt on them; then again the die is being ruined, gets scaly, etc. A dull red is plenty hot enough.

Most emblems are now inlaid on work by passing plates through roll dies. These rolls have the emblems engraved on them so that a final touching up is all that is necessary on the part of the engraver or enamel cutter.

Thick, heavy, and massive parts are usually cast first and then finished by hammering in a die. The large double eagles are gotten out in this way. Other work, as compass and square for charms, is made heavy by first

cutting out of as thick stock as the cutter plate and punch will stand (about 150 points in 14-karat) and soldering two or more together until the desired thickness is attained, when sides are carefully filed up, scraped and polished. Sometimes in special orders a very thick charm is to be sawn out of one piece of gold. This, of course, is at a special price, and great skill is required to get both sides alike. The chief requisites in making emblem jewelry are to have squares, triangles, crosses, etc., absolutely true and perfectly flat, so that there is no danger of going through in the final lapping and finishing.

CHAPTER XLVI.

SOME ATTRACTIVE NOVELTIES.

Bar Pins and Bracelets with Ribbon Background—Ribbon Plaques—Scarf Pins with Stone Backs—The Arrow Veil Pin—Ribbon Bows—Plaque Frames for Stringing Pearls.

HEREWITH are shown some sketches of novelties in jewelry. As before noted, the man who can come along with some new, practical and appealing novelty will get business — sometimes the producer does not get it, but, as our old friend, Rudyard Kipling, says, "That is another story."

FIG. 1

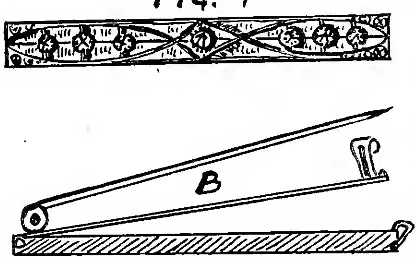


FIG. 2

B

Fig. 1 shows an openwork bar pin, in which ribbon is used as a background. These pins are made in all sizes from one and a quarter inches to two and a half inches and longer. Complete sets are also made comprising a bracelet and pins of various lengths. This pattern is made in 14-karat gold; also in platinum front and in all platinum. They are set in diamonds, whole pearls, and half-pearls. Varicolored ribbons are used so that the wearer may

have different appearing pins to match the dress. The ribbon is easily changed by unfastening the little hasp at the back (see "B") and lifting up the entire back, which works on a joint. All styles of designs are used, tools and cutters being made for those there is any demand for. Fig. 2 shows an effective mounting for three stones, and "B" shows a lower-priced arrangement for holding in the ribbon, doing away with the labor on the hinge and catch.

FIG 3

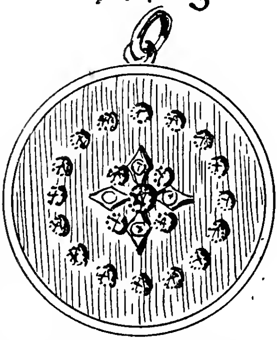


Fig. 3 is a ribbon plaque made on the principle of the drum. The ribbon is stretched over an inner ring and held by another ring closing over. The ornaments are then attached by split pegs. This is best done with the aid of a cork cut smooth and flat. The back ribbon is then added, and, lastly, the outside flange ring. Properly put together, these make very effective and low-priced pendants. They are made in various styles and sizes, in gold, platinum, and diamonds.

FIG 4

FIG. 5

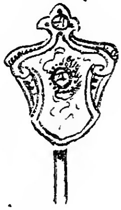
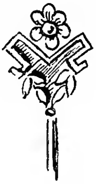


FIG. 6



Figs. 4, 5 and 6 are styles of scarf pins with open centers which are filled up by inserting flat slabs of stones from the back. These stones are cut from onyx, lapis lazuli and other semi-precious stuff, and are sliced as thin

as possible. A few clamps, of either fine gold or green gold, carefully pressed over, holds the stone in place. Fig. 5 shows the center drilled through to hold a tube in which a diamond or other stone is set.

FIG. 7

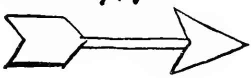
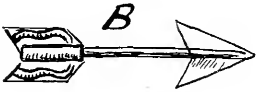


FIG. 9

B



C

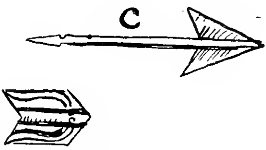


Fig. 7 is an arrow veil pin — they have also been worn as scarf pins. These veil pins have been made in a number of sizes, in plain gold, pearl set, diamonds, enamel, and infinite combinations.

B shows the back with the slot and snap connection. C shows the barb detached, ready for insertion. The prongs that hold the barb should be made out of hard wire; 14 parts fine gold and 5 parts each fine silver and copper is good; they are soldered strongly, only at the end of the feather, so as to allow all the spring possible. The slot is made out of hollow wire drawn with a little smaller hole than the diameter of the wire stem. Then after soldering on the

FIG. 10

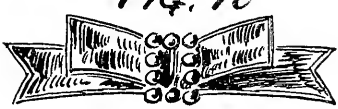
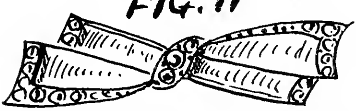
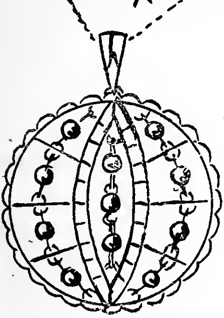


FIG. 11



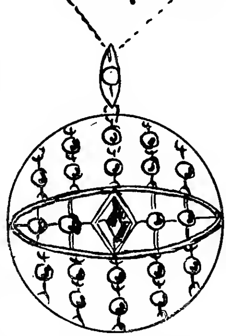
back of the feather (or haft) take and drill carefully to permit of pointed prong just going in enough to snap.

FIG. 12



Figs. 9, 10 and 11 are ribbon bowknots. The first two are made by bending up flat wire over sheet iron forms. Fig. 11 is sawn out of about 120 stock, pale gold for pearl setting, and little wires are soldered across the back of all to hold the ribbon. A little gold eye (ring) soldered here and there and a stitch or two of thread also help at times.

FIG. 13



Figs. 12 and 13 show effective plaques where frames are employed to permit of whole pearls being strung. These are very pretty and dainty when properly made and finished. Fig. 13 shows the center rigid with a diamond-shaped sapphire or other stone center.

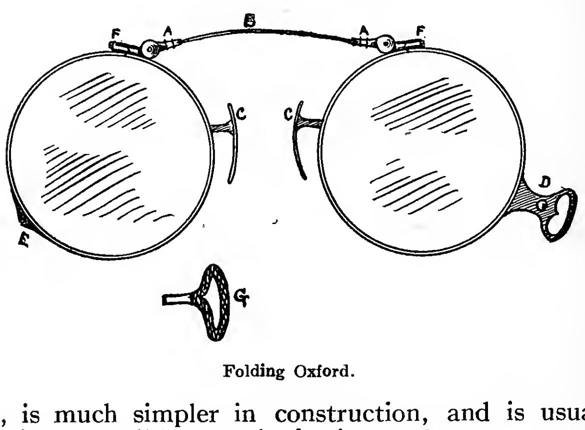
CHAPTER XLVII.

MAKING EYEGLASS FRAMES.

The Round Shape or "Oxfords" Becoming more Generally in Demand—Proper Stock to Use—Inserting the Joint Springs—Dimensions for Stock Sizes—Have "Sizer" for Cutting Lenses—Alloy for 14-Karat Frames and Springs.

ROUND-SHAPED eyeglasses, while comparatively unknown outside of the store selling to people of means, yet are coming into more general use, and at least two manufacturing concerns in New York are making practically nothing but "Oxfords," as they are termed, and lorgnettes, or, to be correct, "lorgnons." Fig. 1 shows a drawing of an Oxford eyeglass which folds over and snaps at the handle and may be placed in the pocket or attached to a ribbon. Fig. 2 does not

FIG. 1.



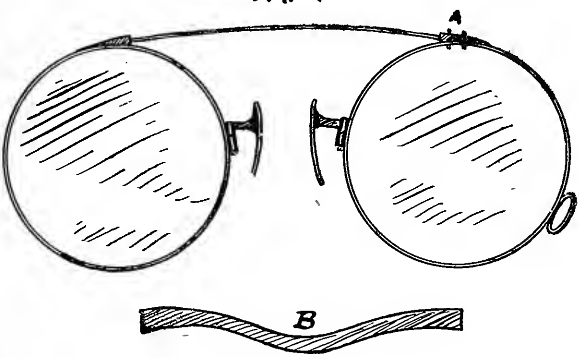
Folding Oxford.

fold, is much simpler in construction, and is usually dangling on a ribbon ready for instant use.

The glasses are cut in three sizes, and when mounted are 40 mm., 42 mm. and 44 mm. in diameter. Special diameters are made to order, ladies' sizes running as small as 35 mm. in diameter over all. The frames are made of half hollow wire tubing and are wound on a hollow iron mandrel well covered with paper. The wire should not be annealed before winding. After securing well on mandrel with plenty of iron binding wire, carefully anneal and the eyes or frames will be formed in a coil.

The joint is covered by the screw hollow wire, Fig. 1, and a knuckle joint, made of about 75 points dial screw gauge thickness, and same diameter as hinge joints A, is soldered up against it. A steel wire coil spring is inserted in each of the hinge joints and the bridge, or

FIG. 2.



Simple Oxford.

flat connecting nose spring, B, is made of gold, well rolled and not annealed, to give further elasticity. The steel wire should be best piano wire, and when a good size, temper, etc., is found it is well to lay in a stock at once, as it does not always run well. Thicker wire

is used in the right-hand glass, as this spring, in addition to opening, also has to carry the other glass. To insert, one end of the steel coil is secured in a slot next to rivet in center of the joint, and the other end is drawn snugly through a hole at side and hooked over. There is quite a knack in this and much patience and experience are required. One man will "spring" up an Oxford in a half-hour and another will waste half a day and get nothing in the end.

The hinge joint is made with tools and goes through several operations. The spring, B, is inserted in slotted ends at A and riveted with two rivets, as shown. The screw hollow wire is first cleaned out with a twist drill and then tapped and sawn through to admit of glass being put in. The saw cut should be somewhat V-shaped, as shown. To make a good joint and preclude possibility of screw coming loose it is best to have thread on both halves of hollow wire. If a saw is used that will take up space of one thread when glass is put in, the two ends will fit close. The easier plan is to open up side which has head of screw, simply depending on other half to hold. This way admits of screwing up close, but there is more likelihood of screw loosening.

The handle, D, is struck in two halves out of 35 stock and is fitted with a U-shaped piece to act as a runaway for folding eye. The click piece works on a coil spring and engages the mouthpiece, E. It is well to bear in mind, in making handles, to keep width as narrow as possible or there will be trouble in getting them to fold neatly.

There are a number of clips or offsets in use, all more or less patterned after other well-known eyeglasses, but the one that seems to find most favor is the so-called "loose offset," as shown at C. This being connected by only one post, will permit wider latitude in bending and twisting to fit the individual customer. G shows a front view of the same offset for which application for a patent has been made.

In making Oxford eyeglasses for stock, the distance between centers of lenses is kept at from 58 mm. to 60 mm.; with a 40 mm. frame, the space between the two frames is about 21 mm., and a 25 mm. space for 44 mm. glasses. The space for the nose is ordinarily made around 13 mm. Of course in special orders all lengths or distances are specified, as a customer might want more offset to keep glasses from touching sides of nose or brows, or less millimeter space, posts higher or lower than regular, and so on.

All stock glasses are neutral and care must be had to see that both eyes are exactly the same size and that glass is tight and does not turn after screwing up tightly. In getting glasses cut, have a sizer made of same thickness and width of eye wire. Do not simply order by diameter only. For instance, a 40 mm. Oxford takes about a 38¼ mm. glass. The glass cutter would get out a full 38½, or his gauge may not be exact, or the bevel edge cut a little too blunt or sharp. Send a sizer along each time and have each glass fitted to it. A split handle is soldered to ends and it is an easy and sure method.

The eye wires in Fig. 2 may be made higher than the other, as there are no springs or joints. Pieces of plate bent double are soldered on at A and the spring, B, is fitted in and riveted as shown. The screw hollow wires are soldered at the offsets and a small oval wire ring soldered on for the ribbon. An excellent 14-karat alloy for the frames and spring or nose pieces is: fine gold, 100 pennyweights; silver, 24 pennyweights; copper, 48 pennyweights. The offsets and handles, points, etc., may be made of a more malleable alloy, consisting of fine gold, 56 pennyweights; silver, 8 pennyweights; copper, 12 pennyweights, and pale Guinea alloy, 20 pennyweights.

A number of Oxfords are made in platinum and in the frames a 20 per cent iridium platinum is used. This makes a frame almost as hard as steel, and by reason of the thinness of the stock used, keeps down the

weight, which has to be considered, not alone for cost, but in keeping the glass as light as possible. As it is, they are more or less heavy and clumsy and cannot be worn for any great length of time. In the platinum Oxfords, Fig. 1, the bridge spring is gold and is nickel plated, this being found the most practical method of manufacture.

CHAPTER XLVIII.

HINTS ON SOLDERING.

Hard Soldering as Distinguished from Soft Soldering—Judgment Required to Select Proper Solder for Average Repair Job—Composition of Solders—Repairing Rings—Soldering Enameled Jewelry.

WHAT is hard soldering as distinguished from soft soldering? The average storekeeper will reply that it is a process whereby the job to be repaired is heated red-hot and joined with gold or silver of a quality a little lower than the article itself. This is true as far as it goes. The highest standard is reached when a piece of jewelry is sweated together with a solder of which the component parts are of same alloy and in about the same proportion, and just enough more of the baser metals added to make the solder about two karats lower quality. A solder can also be made of same quality, as, for instance, certain hollow work is raised and filled so as to assay plump karat quality. This solder is brittle and can be used for no other purpose. A solder one karat baser can also be used, but there is danger of burning or blistering work.

In large jewelry factories, where gold is alloyed, solder is also made for the work, and, knowing alloys used, it is an easy matter to make solder, but the shop doing all kinds of repairing on customers' jewelry,—possibly a shell brooch made in England, a bangle bracelet of unknown quality, or a ring stamped 14-karat and nearer 12-karat, or even on goods that are plump, as per stamp,—it is a matter of judgment and experience as to what solder to use. Sometimes a 10-karat solder will not run before a stamped 14-karat job does and the solder is condemned. On the other hand, a 6-karat or 8-karat solder does not make as fine a job, and of course tarnishes quicker.

The higher grade solders are made of gold, silver and copper, using a few grains of zinc or cadmium where no enameling is to be done over joint, and if these hard running solders are applied to a repair job made of an alloy of gold, silver, copper and one of the various yellow, red or other alloys on the market, the danger of melting the job is more or less in evidence in proportion to amounts of alloys used; for instance, a 14-karat gold of 14 parts fine gold, 3 parts silver, 4 of copper and 3 of alloy, would melt easier than a 14-karat alloy of 14 fine gold, 2 silver, 5 copper and 3 alloy.

These different alloys are used by manufacturers to get certain results. An alloy of 14 pennyweights fine gold, 3 pennyweights 8 grains silver, and 6 pennyweights 16 grains copper, makes an excellent hard, tough gold for knife-edge or wire work, frames for eyeglasses, etc., but would knock the life out of dies in comparatively short order, so that for the latter one of the formulas containing alloy is used, these being more malleable and workable. The least number of base metals in alloying, the less danger of melting, and do not use same weights or quantity. A 10-karat gold of 10 parts gold, 7 of silver and 7 of copper will make a hard spring gold, in fact, brittle almost, but will melt very easily. Alloys of any karat where metals are of the same proportion or nearly so, are used only for snaps for necklaces, bracelets, etc.

Where possible, jobs to be soldered should first be tested, using the needles. By applying pure nitric acid, gold less than 12-karat usually turns black, and by adding a few drops (about 6) of muriatic acid C. P. to an ounce of nitric you will get a much more powerful acid which will turn 18-karat a brown color.

Try best solder on repair work, and if it will not run let cool, re-borax lightly and add a tiny pellicle of a lower grade solder. This will usually melt, carrying the other along with it. The work must be absolutely clean and the joint well scraped or filed. See that there is no oil, beeswax, or other greasy substance on your files. In sizing rings, do not use beeswax on your saw. Just moisten

with a little water or use dry. To make good joint, file V-shape slot in one end and file corresponding end tapering to fit snugly. Do not leave any space to be filled with solder; make a well-fitted joint. In putting a piece in a ring to make larger, or replacing thin shank, the same method of fitting is carried out.

The solder is applied to inside of the ring and well flushed through. The new piece of gold should be very little thicker than gold to which it is to be soldered, thus saving a lot of filing. A lot of labor can also be saved in the polishing, if after the ring is fine emeried, it is carefully gone over with a burnisher. This tool can be of hard steel,—an oval-shaped file makes a good one,—well smoothed off and polished on 4/0 emery paper. The ring only needs to be rouge-buffed in this case for final finishing.

Diamonds, sapphires, rubies and emeralds may be heated red-hot without probable danger, yet it is good policy to remove them before soldering. Where you decide to take a chance, cover well with boracic acid, heat slowly and let cool by itself. In boiling out do not run in cold water at once after pouring off pickle. For small repair work, the jeweler can easily learn to make his own solder. To make a 12-karat solder from 14-karat gold scraps, take 14 grains of the gold clippings, place in a hollowed out part of your charcoal block, and add 2 grains of silver (sterling) and 2 grains of brass, either wire or thin sheet. Well cover the brass, especially with the gold, drop in a little borax or sal ammoniac, place small pieces of charcoal around to get better heat, and melt into a button, flattening while warm with a file or steel block. Hammer out with frequent annealings to desired thinness.

To make about an 8-karat solder from 10-karat clippings, add 2 grains silver and 3 grains of brass to 10 grains of gold. Any quality of solder can be made from any known karat gold in the following manner, viz.: 14-karat is 14-24 fine; by adding to the bottom figure we lower the standard; 14 pennyweights of 14-karat plus 4 pennyweights of alloy is 14-28 x 24 fine = 12-karat; 10

pennyweights of 10-karat plus 5 pennyweights of alloy is 10-29 x 24 = 8 8-29-karat; 14 parts of 14-karat gold plus 8 parts of silver and brass is 14-32 x 24 = 10½-karat for solder, and so on.

Some of the prepared hard soldering fluids on the market are good, especially in soldering for enamel where pin holes are to be avoided, but for plain work a clean slate, bought for a few cents at a stationery store, and a piece of borax well rubbed up with clean water, will answer just as well for a flux. Boracic acid is used to keep a polished color and may be applied by boiling the article in the acid with water or by placing some of the acid in a bottle, covering well with wood or grain alcohol; shake well, apply with a brush and ignite over gas or lamp. This will keep color as well as any of the anti-oxidizing fluids for sale.

In soldering enamel jewelry, prop pin up with iron pins so that enamel does not touch the coal; use only a blue flame. A little practice will enable you to get this. See that no foreign matter is on enamel before heating. If white enamel shows a little smoky, it may be cleaned by rubbing with pumice powder and water. Frosted or etched enamel is re-dulled by dipping in hydrofluoric acid which has been weakened by carbonate of ammonia. In this case it is best to send to a regular enameler, as the operation is dangerous, and lead and rubber cups have to be used; also a flue is needed to carry off poisonous fumes.

CHAPTER XLIX.

POLISHING AND BURNISHING.

Methods and Mediums Employed—The Shop Equipment Necessary or Desirable—Brushes, Buffs, and Laps—Tubbing and Tumbling—Boiling Out before Burnishing—Lubricants for Ball-Burnishing.

WORK for polishing as it leaves the jeweler's hands should be fine emery papered, using No. 1 paper. The principle of polishing simply consists in getting all scratches or marks out. Years ago powdered rottenstone and oil was the medium; now a preparation put up in bar form and called bar tripoli is used for most work. Powdered tripoli and oil is also used. This powder cuts much quicker than the rottenstone, and after rouging the finish is just as good.

Large shops and factories are equipped with polishing lathes having suction blowers to draw away every particle of dust, polishing material, etc., as it flies off the brush or buff, and deposit it in a large bin or can, where it is collected at intervals, burned, and the gold or silver recovered. In addition to making it much more healthful, and a more desirable position for the polisher, the precious metals recovered more than pay for the cost of installing the blower.

In the matter of buying outfits, there are several first-class concerns in Providence and New York who will be glad to send any one interested illustrated booklets, circulars, etc., of new and second-hand polishing lathes, with or without the blower.

The spindle should run very fast to get best results, and for most work not to be lapped, brushes are used. These come in various sizes, those from 2½ inches to 3½ inches diameter being the most popular. See that the brush is well charged with the tripoli. Work should be

kept moving while against the brush, and may be held in a piece of leather, as the friction soon heats it rather too warm to hold. A very few moments suffice to polish out scratches.

On flat work a wood lap is mostly used. These laps are made out of maple, and are purchased from supply houses and screwed on to a plate which fits to spindle of lathe. Charge the face of the lap with the bar tripoli and after lathe is running, press the work flat against the lap. As before said, work must first be smooth.

For other work presenting a more or less flat surface, felt buffs give the best results. These come in various widths and diameters; those running $\frac{1}{4}$ inch to $\frac{3}{4}$ inch in width and about 3 inches diameter are most used for the general run of jewelry. The felt buffs also "break" the sharp edge after metal or wood lapping.

To get inside of small places, where a brush or buff cannot reach, recourse is had to thrums. These are made from leather, chamois strips, etc., or sometimes string is used. In fine platinum and gold work an expert jeweler who can properly polish a finely and delicately made piece of diamond work is able to command good wages.

When the work has been carefully polished it is washed out in a strong soda or lye solution. There are various cleansing solutions on the market, but ordinary washing soda, in boiling hot water, with a dash of ammonia, will make an excellent wash. Get a stiff tampico washout brush, rub on soap, and after work has boiled a few minutes remove and place on a board in the sink and tap the work with brush to loosen any particles of polishing paste, rinse well and dry in hot sawdust. Ovens and blowers are also used for rapidly drying the work.

To get the beautiful luster or high polish, the work is now gone over again, using bar rouge of varying fineness or quality; for gold work it pays to use the best quality. There are special preparations for polishing platinum which may be purchased from supply houses; the brushes, buffs, etc., are the same, and the same methods are followed as described above. While speaking of

platinum, some houses use nothing but common whiting on the final polishing.

After work is first brushed or buffed with the bar rouge the high luster is imparted by means of a cotton or flannel buff, called a rag wheel. A little powdered rouge, mixed with wood alcohol, is applied to work sometimes.

Wash out work again as before, using clean solution, dry in hot boxwood sawdust. Shake or brush out the sawdust well and finish work by touching lightly against a clean cotton buff, running at high speed. The polishing buff and brushes should be kept separate and in a covered box.

The factories are now using tumbling barrels and tubbing machines for polishing a great deal of work. The barrels work on an axis and are partly filled with mixtures of sawdust and polishing material.

The tubbing machine turns laterally, steel balls and a solution of ivory soap and water effecting the burnishing, and a very good finish is obtained, especially in work to be English finished, as, after gilding, the steel balls burnish the colors, giving a rich and a harder luster than that gotten by buffing. Different shops use other mixtures in their tubs: soap bark, borax, tallow, bran water, etc.; but all that is wanted is a lubricant for the steel balls.

Hand burnishers, made of steel, agate and bloodstone, come in very handy for some work. The steel burnisher must be kept bright by rubbing on a piece of chamois and rouge or by polishing on the rouge buff occasionally. For the agate and bloodstone burnishers putty powder is used.

Work for burnishing should first be polished. For a lubricant use either soapy water (clean) or a little clean bran water, made by steeping a tablespoonful of bran in a cup of boiling water. Place work on a clean block of wood covered with cloth and keep wet while burnishing. Do not press too hard. In silver plating spoons, etc., various curved burnishers are needed. These can be purchased at jewelers' supply houses. After burnishing, the work is finished by soft buffing with powdered rouge and alcohol.

To get extra heavy plating, work may be plated and burnished, repeating the operation several times, if desired. This gets a much more durable deposit than if work received one long dip and only one burnish. Of course, in this case the soft buffing is only done after final burnishing.

The whole secret in polishing is to get all the scratches out without making the pieces of jewelry any lighter than absolutely necessary — not like an alleged lapper and polisher who applied for work, saying he was an expert on fine goods. Being put to work, he lapped away the side of a silver cigar case about the thickness of a fifty-cent piece. Upon inquiry, he was found to have worked formerly in a flatiron foundry.

CHAPTER L.

CASTING IN CUTTLEFISH AND IN SAND.

Making of Models Needs Careful Attention—Must be Formed to Leave Impression Freely—Cuttlefish Largely Used for Small Articles—How to Make the Mold—Melting and Pouring the Metal—Advantages of Sand Casting.

TO get results in casting, considerable attention must first be paid to the models. These may be made out of brass, silver, tin, ivory, modeling wax or plaster of Paris. Silver is most generally used where much carving is done, as the metal is easy to work. Nothing perpendicular should be used as a model; rectangular models are tapered slightly, also the inside edges of rings; carved patterns must not be undercut; animals should not have the legs open or separated; these are cut apart afterwards. Parts like the tails of dogs, cats, antlers of stag, etc., are applied after the casting is made. The model, in other words, is so made that it will leave the impression freely. Models are generally made a little larger than the object desired, as the metal shrinks a little in cooling after pouring. If the model is found to be too small it may be "padded" by either painting with shellac dissolved in alcohol, or the shellac may be melted on the model and then carefully scraped or filed to the desired thickness.

Cuttlefish, by reason of the facility with which it is handled, is largely used in the casting of small work, rings, ornaments, etc. It should be kept under a bench where there is a circulation of air, no dampness, and away from a stove or steampipes, as it is liable to rot or dry out and crumble in taking the impressions. For a plain gypsy ring or similar work, two pieces are taken, about three times the surface area of the model, and faced flat on a

piece of emery or sandpaper. The model is pressed half-way in one face about half an inch from the end, the other half now placed on top and pressed down close. Now saw or file the four sides flush and mark with four or five saw cuts on three sides. This is done so that when the two pieces of cuttlefish are pulled apart and the model removed you will be able to fit the mold together again exactly as it was. The end not marked with the saw is now carefully hollowed out and a "run" made to the impression about the thickness of the ring, remembering that the heavier part of any model is always at the bottom, or farthest away from the entrance or "gate" of the mold. In heads or other solid ornaments the run need not be over three-sixteenths of an inch in diameter.

A few scratches are now made across both faces as air vents and held over a smoky lamp to blacken up well. This fills up the pores of the mold somewhat and makes a smoother casting. Now bind the two pieces together, after making sure no particles of cuttlefish have gotten loose in the mold; make sure that the saw-cuts exactly miter as they did when the model was in, and attach with more of the iron binding wire to your charcoal which has been hollowed out and has a run meeting the gate in the cuttlefish.

In melting gold a much easier and more fluid casting is obtained by adding a few grains of zinc just before pouring, and this lessens the dangers of porous spots and specks. Be careful of the zinc,—only three or four grains to about fifteen pennyweights,—or gold will show pale and be brittle. On claw or cluster rings it is necessary to use three pieces of cuttlefish, the third piece being tied or pegged across one end of the other two. This end piece takes the head or setting of the ring. In using pegs, sharp double-pointed pieces of wood are used, one end being pressed in the face of the mold about half-way and the other half pressed down over same, as before described. It is also well to use iron binding wire to secure firmly.

The metal must not be poured too hot, and some experience will be found necessary in judging just when to pour. In casting from a crucible where a dozen or more molds are filled it is necessary to move quickly, but an expert can shift from one to the other rapidly, and should the metal solidify before all the castings are made it is simply remelted. The rule usually is to let the crucible get a dark red down to the melted metal before pouring.

Casting in sand calls for more outlay and experimenting at the start, but is cheaper in the end for larger pieces or for articles not calling for fine detail, like cluster rings, etc. Procure a casting flask from a jewelers' material supply house and some casting sand from a brass foundry, the finest they have, sift well to remove small stones, lumps, grit or other foreign substances, dampen with water and mix well. The sand for facing must be the finest of the sifted, and dusted with lycopodium or pea flour. Place the eye side of the flask on a smooth board, and dust inside well with the facing sand. Then fill up with the casting sand previously dampened and mixed and press firmly into the flask, finally tapping down with a wooden mallet. Scrape edge smooth, place a board on top and invert the frame, lifting up the under board.

Now place model in position and dust the face with the facing mixture and also a little fine charcoal powder in a bag; remove the model and the outline will be left on the sand. This is carefully cut out so the model may be let in about half-way. Now fit the peg side of flask into the eye side and fill with sand, being careful not to press too hard to avoid displacing the sand in the other half. Remove the peg side with a board cover, take out the model, scratch a few lines for air vents, cut out the gate and the run, carefully blow out any particles of loose sand with a hand bellows and smoke both faces well, using a very smoky lamp-rag soaked in linseed oil, or soot from a piece of stick dipped in pitch.

Points to remember are that your sand must be well packed in the frames to prevent falling out while turn-

ing over. The facing sand must be fine and dried with the pea flour or lycopodium to prevent the moisture from sticking to the board or the face of the other frame, and dust the charcoal powder on before "sooting" to fill up the pores and prevent any action the molten metal might have in coming in contact with the sand. The casting sand must not be too damp, just enough to permit working and firmly pressing together. In this connection some molders mix in a little molasses.

The beginner would do well to experiment with rather plain solid objects, cat heads, or other animal heads, later on trying a bird flying, etc. When more familiar, sand working right, etc., a dozen or so pieces may be cast at once, using the one gate with a run to each model, the whole casting resembling pretty much a tree. In this case one can readily see the economy in using the sand, as the price of cuttlefish has advanced considerably, and desirable sizes are also hard to get.

CHAPTER LI.

PRACTICAL HINTS FOR WORKING JEWELERS.

Venice Turpentine for Polished Work — How to Make the Solution — Coloring Soft Solder — Soldering Hints — Use Caution with Cement-filled Jobs — Soft Soldering on Pearl Paved Work — Fixing up Cheap Jobs.

VENICE Turpentine—This is a soft soldering solution made by dropping resin (obtained from your plumber or tinsmith for a few pennies) into spirits of turpentine, and leaving until dissolved. This may take a few days, until enough resin has been added to make solution the consistency of a syrup, or a little thicker, possibly. This soldering solution is used in joining polished and finished parts together, where it is not possible to do any further polishing, notably in assembling the different emblems of a badge or medal. Take, for instance, a Masonic emblem: the lapped, mirror-finished Maltese cross is to have a keystone applied on one side and a Knight Templar cross with double eagle on the other. When it is impossible to attach these parts by any more riveting, they are soft soldered on. Bear in mind to have solution thick. The solder will run only where the "Venice" is applied, hence there is no danger of smearing over work unless the solution is too thin and runs about. After soldering and before getting quite cool, the article is plunged into alcohol (either grain or wood), when any sediment is instantly removed and the article is clean and ready for shipping.

* * *

To Color Soft Solder — After soldering, moisten by dipping a piece of wood into a solution of sulphuric acid 1 part, water 9 parts, well rubbing over the part, which should be previously cleaned from all traces of soldering acid by well washing and brushing with *clean* cold water

only. Touch with the freshly filed end of a piece of iron wire or nail and a red color will show. If a yellow color is now desired, after drying again moisten with the acid and touch with a piece of zinc. In larger work the article is first thoroughly cleaned by dipping in a potash lye solution to remove dirt or grease, then brushed with a brass brush and dipped or painted over with a solution of sulphate of copper dissolved in boiling water; let dry, moisten with acid as before and touch with iron. The above recipes are good for making a background for the final dip in the gilding solution, or even where it is desired to get a cleaner job.

* * *

Soldering Hints — In all jobs that come in for soldering be sure to examine the articles thoroughly before going ahead; see that no other parts are soft soldered near the broken place, which might be liable to become unsoldered and make trouble for you. Always see that the work is free from dirt or grease and that the cheaper rolled plate articles are not filled with cement. Scrape well the parts to be soldered, use only enough acid to moisten well, have the parts fit snugly; do not depend on solder filling up crevices. In the case of cement filled jobs it is generally best to use a soldering iron. This iron is best heated by resting in a fork made of iron wire so that the point is in the gas flame. Do not allow it to get red-hot. Regulate your gas jet so that after the iron gets hot enough, it will stay at about a soldering heat. Solder as quickly as possible to prevent any heating of the cement and a possible squirting out of the same.

In soft soldering tableware try all the parts of the article before proceeding. Many a job has been a "deadhead" from simply taking for granted that the whole piece was hard metal, just because a part of it was; after going merrily along and blowing away there is a sinking in of the bottom or side, as the case may be, and a couple of hours' work (for nothing) is now confronting you. In repairing this kind of work, little strips of zinc,

white metal, German silver, nickel, etc., can be used to advantage. Oftentimes a fracture obstinately refuses to solder; let it cool, scrape well, drop in a clean piece of metal and you will get a secure joint. Men who are expert in repairing "lead" ware use the mouth blowpipe, as being the quicker way, but the average shop jeweler would do better to stick to the copper soldering iron.

A good soft solder is made of 2 parts lead and 1 part tin; a softer one is made by using more lead. It is generally best to use the solder supplied by reliable supply houses, although it may be made by melting in an iron ladle over a coal fire and stirring well.

* * *

To Soft Solder a Joint or Catch on a Pearl-Paved Pin or Brooch — Where the space is limited, as in a sunburst, first fit a plate, letting it run down at both sides, then hard solder joint or catch to the plate; remove one or two pearls and drill a small hole through. A peg is soldered on to the plate, which is now carefully soft soldered to the brooch, using soldering iron. The peg coming through the hole is cut off and gently riveted, and the pearls reset. The brooch during the soldering should be wrapped in wet tissue paper, and if fearful of spoiling, it is best to remove a few more pearls at the soldering point. A knife-edge job is done in the same manner, excepting that a rivet goes right through both sides of the plate piece and the knife-edge wire, which being riveted on both ends like a pin joint, is made firm and secure. Where the surface will permit, use as large a plate as possible, to which the joint, catch, or scarf pin is first hard soldered and polished, before soft soldering to the job. In all this kind of work the zinc muriatic acid is used, and if solder is moistened as well as other parts very little acid is necessary. To get a clean joint, first run the solder on the plate, scrape off scum and an excess of solder, then just moisten both parts to be connected, apply a small pointed flame (or a soldering iron) and as soon as solder runs cease blowing. There are a number

of tweezers, pliers and other devices on the market for holding parts together, but whatever you use, be sure that solder doesn't run out and solder tweezers and all. At the same time be certain that a good joint has been made. Some repairers prefer, for a great many jobs, to use an alcohol lamp, holding work right in the flame. This is good, in that you can watch closely for solder to run, but is not so safe when the heat is required to be kept at the point of joining.

In vari-colored gold or gilded goods, the acid is kept from running where it is not wanted by painting the parts with yellow ochre and water or whiting and water. In repairing an article that has been soft soldered in a number of places, and there is danger of the whole thing coming apart, take fine iron binding wire and carefully bind so that none of the parts will pull or be detached in the soldering. This will oftentimes prevent a lot of trouble in fixing up cheap jobs. In taking in fine goods for repairing, the jeweler should endeavor to impress the customer with the desirability of having the article made as new; if the charges should be more than he or she is prepared to pay, the soft soldering methods as given in this article may be used.

CHAPTER LII.

PRACTICAL HINTS (Continued).

Refilling Links and Repairing Link Chains — What to Tell the Customer — Examine Thoroughly for Soft Solder — Attaching Metal Ferrules to Wood — Soldering Nests — Jointing Heavy Rings — Stripping Chloride Coatings.

REFILLING and Renewing Chain Links — The repairer is frequently called upon to solder a heavy curb or open link vest chain. Before accepting such a job examine the other links and you will find that probably most of them need renewing. The average customer wears his chain until it is worn to such an extent that a break occurs and he thinks it is only necessary to have it soldered. In a case like this show the chain to him and tell him it must be refilled with gold in order to put it in a dependable condition.

Before proceeding, weigh the chain carefully, keeping a record, and weigh again after work is done so that you will know the amount of gold added. While good jobs are done by filling with solder only, yet a more durable job is made by fitting pieces of gold in the worn places. When the smaller rings of the chain are badly worn, it generally pays to replace them with entirely new rings, as the labor of refilling is more than the cost of the gold. The chain should first be annealed, boiled in pickle and the parts to be filled scraped. The solder should be cut in pieces just large enough to fill nicely, or a little more, perhaps, to allow for polishing. If solder is well flushed it will fill up the worn end of the link, so that after polishing the chain will look as good as new.

In refilling worn swivels, spring rings, etc., be sure to first remove the springs inside and carefully boil out the parts in water and ammonia after pickling, to kill all acid before putting the springs back in. Chains of small links,

as cable chains in the form of necklaces, lorgnette or bag chains, when badly worn are best repaired by cutting out the weak parts and replacing with new sections.

Of all chain patterns the one most botched in repairing is the rope or twisted design. The average repairer shoves the broken ends together and puts on a piece of solder large enough to solder a dozen feet, the result being a stiff joint in the chain anywhere from a quarter of an inch to an inch and a half long, besides making an eyesore of a job. The proper way is to first cut off the broken, jagged ends, and you will find two links soldered together; file end through with a needle file, or a fine saw will do. This operation is done on both ends; now link together, borax carefully, apply very thin and small pellicles of solder, and solder with small pointed flame. If properly done the chain will be flexible and as good as new. Be sure that chain is clean before soldering.

In fastening connecting rings to the ends of rope chains the ring is opened to clutch the end of chain; borax the joint only, and after letting it dry, in order to prevent possible running of solder into the links of the rope, paint with yellow ochre and water, being careful not to get any on the borax. If a quick pointed flame is used, however, there is little danger of solder running elsewhere. Some jewelers first run a little solder on the end of chain, then file flat and place ring against the part. This is double soldering and takes more time.

Another thing to advise a customer is, that in the renewing of his vest chain it will finish a shorter length, as all the worn spaces will be filled up, thus bringing links closer together. It, of course, simply shortens chain to original length, but some customers get the idea that a link or two has been left out, and it is well to speak of this before rather than after the work is done. A chain of thirty links will take up an inch or more in refilling. In repolishing chains, unless the links are of the large, open kind, easy to get at with thrums (strips of chamois or string), the most practical way for the storekeeper doing his own repairing, is to brush well on the lathe,

using powdered tripoli and oil, wash well in boiling water with soap and ammonia, or a lye solution, to remove all grease, etc. Then give a quick flash in Roman solution. This will give a yellow tinge to parts not reached in polishing, and after finishing with rouge brush, the chain will present a rich, highly polished finish.

Before doing any hard soldering be sure to examine a chain thoroughly for any traces of soft solder. Sometimes the more fancy chains have been repaired in this manner.

* * *

To Attach Metal Ferrules to Wood — To put ferrules, or bands of gold, silver or other metal on pipes, canes, umbrellas, etc., first get the size by cutting a strip of paper of desired length and width. This strip may be a little longer than necessary, so as to lap over when shaped around pipe. Run your fingernail down the seam and cut the metal accordingly. Make a good joint, having ends come together flat, rather than V-shape, and tie with iron binding wire, just tight enough to keep a joint. Borax well on inside and just moisten seam on the outside; place on two or three pallions of solder and flush well through. Boil out and round up on tapered mandrel.

Stock for ferrules should not be much less than forty points in dial screw gauge, and for square bands it should be a little thicker. An excellent cement for fastening them on pipes, is mucilage and plaster Paris, mixed to a creamy consistency. Work quickly, as this sets rapidly, and be sure the ferrule fits properly before applying cement.

* * *

Soldering Nests — Iron binding wire coiled, twisted, and somewhat hollowed in center, with a handle of thicker wire made by twisting four strands and bending their ends over the "nest," are an excellent soldering stunt. These hold the heat and are used for all work not requiring a flat surface. Another one is made by placing

a few layers of wire mosquito netting together and clamping by the aforesaid iron wire handle. These admit of getting a flame all around and under the work, and beat the charcoal or asbestos block a mile, where clean soldering and well flushed work is desired, and besides, will outlast many charcoal blocks.

* * *

Jointing Heavy Rings — To bring ends of heavy rings together, wedding rings, etc., where it is difficult with small facilities to get them to touch, wind heavy binding wire around the ring and twist it to draw tight, then anneal, and if not well mitered, run your saw through, repeating the operation until you get a clean joint for soldering. Remember that good jointing obviates pin holes, takes a better polish and lessens chances of rebreaking.

* * *

A Stripping Solution — All new solid gold work as it comes from the jeweler or from the enameling room, presents, after boiling out in the regular "pickle"— sulphuric acid (commercial) and water, or "acid"— a weak solution of nitric acid and water, a dull white or slightly greenish color. This is caused by the action of the acids on the alloys in the gold, the silver forming a chloride on the article. This coating is removed by hanging the work in a stripping solution as the anode, using a carbon plate as the cathode. To make the solution, mix fifteen ounces of C. P. cyanide of potassium in one gallon of water and add thirty ounces of phosphate of soda which has been previously mixed in a little water; place this in a tank, heat up well, and after the work has been well scratch-brushed with a steel brush, hang it in; run the current up to five or six volts, seeing that the connection is good; the article should be kept in motion, but not allowed to touch sides of the crock or the cathode, as, by reason of the strong solution and powerful current, should

it do so a "strike" spot would be the result. After a few moments' immersion the work will show red and is ready for polishing.*

Goods that have been enameled and subjected to a number of "firings" of course have a thicker coating of oxide and will take longer to strip. It is not advisable to leave goods in the bath longer than necessary to get a nice, clear, reddish color, as the solder will be weakened and the article itself be attacked. This solution must be renewed by adding a little cyanide and phosphate of soda from time to time, or when it is noticed as not working well. The weights given here for all dry ingredients are Troy, and for the liquids the regular graduate is employed.

By the way, in the stripping process the carbon plate (cathode) should be placed in a bowl of water after using, and the gold, silver and copper deposited thereon during the stripping brushed off with an old stiff tampico brush. This water should be emptied into a glass funnel lined with filtering paper placed in a large pitcher; the precious metals will be left on the paper, and as enough is collected, remove and dry for refining, replacing with fresh paper.

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*This solution is now practically discarded in favor of the new one given in this edition in Chapter III, which works quicker in the hands of an experienced stripper.

CHAPTER LIII.

PRACTICAL HINTS (Concluded).

To Make Colored Gold Plating — How to Secure a Matt Finish — Cleaning Stock-Worn Goods — A Reliable Pearl Cement — Eating Copper Out of Plated Ware — How to Polish Platinum — Rose Gold Solution.

COLORED Gold Plating — In making colored gold plating, green, red, yellow, etc., have the colored gold a little over one third the thickness of your backing, or 250 points dial screw gauge as against 600 points for the polished back. The two pieces should be well fitted, filed, scraped, etc.; borax carefully and use highest quality solder; small pieces may be soldered with a regular blowpipe, but the large plates should be placed between two iron plates and put in a gas muffler or furnace, keeping the heat well under control, as at point of sweating there is danger of melting gold as well. All plating should be well annealed during rolling, and for small flowers, leaves, etc., may be rolled as thin as 60 points.

* * *

Matt Finish — To get the beautiful matt finish, work after leaving the chaser is put in a hot steaming solution of water and soda to remove the cement, washed out well, and then covered with a paste of yellow ochre rubbed up well with water and borax; it is then carefully annealed and boiled out in the pickle (sulphuric acid and water) and dried in sawdust. Stock-worn goods may sometimes be cleaned by dipping in cyanide of potassium, bicarbonate of soda, phosphate of soda, etc., but to make like new, the work must be rechased or matted and "fired."

* * *

Pearl Cement — While there are some excellent pearl cements on the market, the strongest cement for the large baroque pearls, in fact, pearls of any size above a grain, is white shellac; this has a coarser grain, is very tenacious, and is used by the finest platinum jewelers for fastening on the most expensive pearls. It is purchased in lumps from leading chemists and should be kept in jars under water; when wanted, take a piece and draw into thin strips over your alcohol lamp, discarding any that is apparently useless.

* * *

Eating Copper out of Plated Wire — Hollow wire work drawn over copper is eaten out with a solution of nitric acid and water, using, in 14-karat or over, equal parts; in 10-karat or less, use three parts water and one acid, which must be chemically pure. In the case of a special pattern, as in a bracelet, where it is not economical to use plating made specially, the gold is drawn over the copper wire which has been previously drawn to the size, less the difference in the thickness of the gold, and is then closely wound with iron wire to keep the seam from opening up and buckling in the subsequent shaping on the arbor. After shape and size is gotten the wire is unwound and the bracelet put in the acid; add fresh acid every three hours, keeping slightly warm. In 10-karat work especially, do not leave any longer in acid than is absolutely necessary. Some manufacturers use a pounder to keep acid constantly stirring. The pounder is made by hanging a weight to a crank attached to the shafting, letting it strike bench as shaft revolves.

* * *

How to Polish Platinum — Platinum work, after fine filing and well rubbing over with fine emery paper, is polished on a high speed polishing lathe, using "platinum bar tripoli" and finishing with "platinum rouge." Platinum may also be polished with the regular bar tripoli and bar rouge, but a much richer gloss and

finish is obtained by the use of the special polishing ingredients first named. The regular tampico brushes and the felt buffs are used. The higher the speed, the better are the results. Sometimes in broad surfaces a streak will show. This is due to bad melting and mixing of possibly a portion of silver or iridium with the platinum. Go over the part with a highly polished bloodstone or steel burnisher and finish with the platinum bar rouge, using a felt buff. Pure platinum is soft, and is apt to "drag" in polishing, and it is therefore necessary to have the article smoothed with the finest emery paper before sending to the polishing room. All of the finest diamond work is polished in this manner, and in the hands of a skillful and experienced polisher the finish presents a deep, rich, glossy luster, closely resembling newly plated nickel work. The buffs and brushes used for platinum work must be kept separate, and the work well washed in soap water in which a few drops of ammonia are put before finishing with the rouge.

* * *

Handling of Vermicelli or Etruscan Work — Vermicelli or Etruscan work, i. e., plain surfaces ornamented with twist wire half rings, plain wire strips, shots, etc., is prepared and trimming charged on as follows: Work is tripolied or fine emeried, annealed and boiled out in the regular pickle and well rinsed in hot and cold water to remove all acid; dry well and paint over lump borax well rubbed up with water; do not get too thick so that the surface is lumpy; now anneal with blowpipe, keeping the various pieces from touching. In applying the borax see that the surface is covered evenly. The writer uses his finger moistened with the borax, and well rubs to get the surface clean from any traces of grease, shiny spots, etc.

The twist wire rings are now prepared, the article is painted over with a solution of gum water made by dissolving gum "tragic" in water and the rings picked

up with a small brush which is kept wet with gum water. When the piece is "charged," let dry, then take a brush (a tooth brush will do) and dip in your borax slate, hold over work and run your nail over the bristles, thus sprinkling work; avoid all excess, just enough to dampen. Have a metal solder box containing file solder which has a stem running from it, through which the solder feeds. This stem is notched, and the finger-nail scratching over the corrugated surface causes the solder to drop on to the moistened work. Be careful to charge the solder evenly. Now sprinkle again and solder before it gets too dry. Small pallions of plate solder, rolled very thin and cut in tiny squares, are also used for certain trimming where it is found to be cleaner and more expedient.

In large factories, where, say, fifty ball hat pins are in work, the balls are stuck on steel pins and the points in a cake of soap. The balls are annealed in borax, then given to girls who do the "charging," back to the foreman for sprinkling and charging of the solder and soldering. The borax applied to the brush for sprinkling is rubbed up very thin. The chief feature in vermicelli work is to have the article thoroughly clean in the beginning and evenly and smoothly annealed in clean borax. All hollow work, after the preliminary annealing and pickling, should be thoroughly boiled in water in which a little powdered borax may be dropped to kill all the acid. Gum water must be pure and not too thick. A little thinner than the regular mucilage is about right. Bear in mind that the trimming is charged right on to the borax annealed work.

* * *

Recovery of Fine Gold — Commercially pure gold, approximately 24-karats fine, is recovered from alloyed gold by first adding fine silver so that fine gold will be one fourth of the weight. In other words, add silver so as to make 6-karat gold. If, for instance, you have 100 pennyweights of 14-karat gold, and knowing that

there are 58 1-3 pennyweights of fine gold in this, we add 133 1-3 pennyweights of silver; this, with the 41 2-3 pennyweights already with the gold, makes 175 pennyweights of alloy to 58 1-3 pennyweights of gold, so that we have three times as much alloy. Melt and mix well, then either granulate by pouring into a large tub of cold water, which is vigorously stirred by a helper, or pour into a plate ingot and roll thin. Place in a bowl or evaporating dish on sand bath. Cover well with 1 part nitric acid C. P. to 2 parts water, keeping a good heat. As the silver and other alloys are taken up in the acid the gold will be precipitated to the bottom in the form of a reddish, muddy powder. The American Oil and Supply Co., of Newark, N. J., furnishes a regular parting acid. Pour off and add fresh acid from time to time until all action ceases. Wash well with hot water, using several washings, then pour in a solution of 1 part sulphuric acid to 9 parts water. This will bring up gold a clean, pure red color. It is now well washed again, dried on the sand bath, collected into a new, clean crucible and melted. To get chemically pure gold involves a number of operations and an equipment making it impractical for the average jeweler to attempt. The latest process is using a hydrochloric acid bath with two large bars of commercially pure gold as anode and cathode. A current being turned on, the gold is deposited on to the cathode chemically pure, all traces of platinum, iridium, etc., remaining in the bath, the baser metals, lead, tin, iron, antimony, etc., being destroyed in the solution. Commercially pure gold, if carefully gotten out, will test 23 9-10 karats fine, or better.

* * *

Rose Gold Solution — A rose gold solution is made by adding copper to the regular gilding bath. This copper can be purchased from the larger chemical houses in cyanide form, simply getting cyanide of copper; or carbonate of copper may be gotten from any supply house. The cyanide copper powder may be put

directly into the bath, but the carbonate is first dissolved in water in which cyanide of potassium has been previously dissolved. A good copper cyanide solution consists of carbonate copper, ½ lb.; water, 1 quart (boiled and cooled); mix together and add small pieces of cyanide of potassium occasionally, until all the copper is taken up in the solution. Carefully add this to the Roman bath until deposit shows pinkish red. Bath should be hotter than for gilding. Current from 3 to 5 volts. Relieve with glass brush.

CHAPTER LVIV.

APPENDIX.

FIGURING SHOP COSTS.

Some Supplementary Figures Relating to Cost of Platinum Work and the Buying of Diamonds and Pearls—Further Explanatory of the Subject as Treated in Chapters XXXII and XXXVI.

SUPPLEMENTING Chapter XXXII, a young New York manufacturer of fine platinum jewelry asks how to figure costs on that class of goods. He is a very fine jeweler but knows little of the clerical end of business. The following example covers every operation on a platinum pin:

Platinum (8 pennyweights) $64, making (10 hours) $20, polishing $3, setting (60 stones) $12, joint and catch and finishing 50 cents, a total of $99.50, to which is added 25 per cent for shop expense, making the cost of the mounting $124.88. This may be a little excessive for shop expense but the percentage is left to individual judgment. Now the profit is added, which may be anywhere from 25 per cent upwards, with, of course, the stones used also figured to sell at a profit.

On a general line of medium-priced jewelry, either 10-karat or 14-karat, where enameling may be included, manufacturers are generally putting on 33 1-3 per cent for shop expense.

Example—Bar pin. (Figures given are merely illustrative, showing how cost is arrived at.) Gold $2, stamping 10 cents, making 40 cents, enameling 25 cents, polishing 15 cents, setting 20 cents, joint and

catch and finishing 20 cents, total $3.30, plus 33 1-3 per cent, making the cost $4,40. This is not excessive on a popular line where a tool room and enameling plant are maintained in addition to other departments.

The Buying of Stones—Referring to prices of diamonds as noted in Chapter XXXVI, it is useless to name any fixed costs—"There ain't no such animal." The point made was, and is to-day, that diamonds, 200 stones to the carat, cost more proportionately than those averaging 80 to 100 stones per carat. The reason is the scarcity of these small brilliants. They are very costly to cut, and are generally cut from larger stones. Also, the stuff must be very "snappy" in order to show up. These tiny diamonds are set in heads of animal jewelry, special models of birds, dogs, etc., also to embellish prongs or settings holding a large emerald, star sapphire, or other stone.

Regarding pearls the same statement applies in relation to prices. Whole pearls, Oriental baroques, and sometimes Japanese cultured pearls, are bought and sold at what is termed "base" price. This can be anything, and it depends on the quality, size, lustre, skin, etc.

Once knowing what the pearl is quoted per grain *base*, the buyer proceeds to get at the actual cost, as follows: Suppose he wants a pearl weighing six grains at $1 "base," which means that a one-grain pearl would cost $1; a six-grain pearl would cost $6 per grain *base*, or $36; a seven-grain pearl would cost $7 per grain base, or $49 for the pearl.

As explained in the previous chapter, multiply the quoted base price by the weight of the pearl and this product again by the latter, or, in other words, the square of the weight in grains multiplied by the price per grain base gives the cost of the pearl. This is perhaps more readily understood in buying a paper of pearls of different weights, at say, $3 base: a one-grain would cost $3, a one and a half grain would be

$4.50 base and cost $6.75; a two-grain at $6, would cost $12, and so on.

The cheaper pearls, fresh-water or domestic, are generally sold by the grain only. Figuring a lot of different sizes at 50 cents per grain, simply multiply the weight of each by the price per grain, as, a two-grain at 50 cents, costs $1, a six-grain costs $3, etc.

PART TWO

How to Make Plated Jewelry

By Alvan H. Whiting.

CHAPTER I.

THE LOCATION OF THE BUILDING.

A Series of Articles on the Processes of Making Plated and Electroplated Goods in Quantities—The Basic Combination—Selecting the Location—Pick out a Good Building—Equip with Up-to-date Machinery if You Mean to Succeed.

IN preparing a treatise on "How to Make Plated Jewelry," we will first take up the question of "What is plated jewelry?" As generally known, it is an imitation of gold jewelry made from a base metal and covered or plated with gold. It can be divided into two classes: First, goods in which gold is soldered to the base or platers' metal in the ingot, rolled into sheets or made into wire; then made up into the component parts, assembled and finished, and as the gold is on the outside it is known as plated goods, or stock plate. The second class is electroplate. In this case the components are made from the base metal, assembled and plated or colored by depositing gold on them by use of an electric current.

Then there is what is known to the trade as "gold-filled" jewelry, but as this is entirely an arbitrary term that may apply equally as well to either of the two classes mentioned, we will not consider that in a

separate class, but will proceed with the subject of how to make jewelry by modern and paying methods.

Briefly, it is a combination of brains and brass; the brass to be covered or hidden with gold. Brass is not a natural, but an alloyed metal, consisting of copper and zinc, and known to the trade as high or low brass, high brass having a high percentage of zinc, and low brass a low percentage in zinc and high in copper. The manufacturer of plated jewelry needs to know very little of these formulas, as it would be impractical for a jeweler to make his own metals; that is the brass mill's job. The manufacturing jeweler simply buys sheet metal or wire of the grade best suited to his trade, which is almost always low brass, or sometimes what is known as gilder's metal, which is still lower in zinc, the reason for which will be taken up later.

Making the component parts, assembling, finishing and selling, are the same factors as in jewelry. The use of brains consists of finding methods of doing these things cheaply and well with a minimum of hand labor; and right here let me say and emphasize, specialize and standardize. There may be rare cases where manufacturers have made a success and become rich by making a general line of plated jewelry without specializing, but in forty years of watching it I have yet to hear of them. If I were asked to give advice on how not to succeed in making jewelry, and name one hundred ways to fail, I should say, first, make a little of everything; the next seventy-nine rules would be just the same, and the other twenty would be "don't standardize."

The attempt to make all kinds in the same factory is now almost never done, except in some town far away from a jewelry center, in which case, the owners are doomed to failure before they begin. Here is a good chance to steal a leaf from the farm papers. In telling you how to succeed in raising anything, from peas to

pigs, the advice is always, first, pick a suitable location. Take the same advice in making jewelry. It is most suitable to pick out a location right in a section where similar factories are located.

The man who locates his jewelry factory from ten to a thousand miles from another jewelry factory may succeed, but if he does I hope he will have his portrait hung in the "Hall of Fame"; I would like to look at it. Perhaps the reader will ask why. First, the little matter of stock. It is rather inconvenient for a factory to have on hand all kinds and thicknesses of brass, both in sheet and wire. If the factory is in the jewelry section the brass agencies carry that for him, saving time, expense and losses on dead stock.

Then there are a hundred and one other items of supplies that are as easy to procure in the right section as a glass of soda or other thirst quencher in a drug store, while the distant and isolated plant finds it a source of trouble, mistakes, high prices and annoyance.

If one overcomes this handicap, the trouble has just begun. There is no available skilled help in the branch of the trade that he needs just now. But we can always get help to emigrate. Granted; but why does a man leave a town full of jewelry factories and go to an isolated plant? Answer, more money, though there are other reasons as well, but it is not polite to talk about them. However, if you wish to try it, it is your affair, and the second-hand machine dealers will go a thousand miles to bid on the ruins, as they have found that they can buy the goods very low in such instances.

After finding your location, hire your factory space. Do not be stingy with the landlord. Good, modern, up-to-date factories pay the best. Paying for a trifle more room than you could rub along with is a better policy than crowding into a place too small. See any successful manufacturer.

Then there is the little matter of power. There are still factory buildings renting floor space including all

the power you care to use or misuse, all covered by the same rental. That appeals to some short-sighted tenants, but have you considered that they are all buildings that were erected before the day of modern electric motors, and the owners are using and renting that kind of power for the same reason some of us are wearing last year's straw hat. We have it, and have not yet got up our courage to give it to the junk man. "Eventually" you will be forced to use power that you can pay for by meter. "Why not now?" Then you do not have to pay for power that you do not use. You can increase any time, besides other advantages about which any mechanical engineer can tell you.

In equipping your shop get the most modern machinery adapted to the line you mean to make. Begin where the other fellow left off. Don't try to get along with what he has scrapped, and expect to compete. Be sure you get harmony in this matter, not one machine for doing the heaviest kind of work that could possibly be classed as jewelry, and the next one for the very lightest and most delicate goods. In that case you are equipped about as well as the man who wore a fur coat, straw hat, and rubber boots. Was he dressed for spring, summer, autumn or winter? Could he drive a team, or make a speech at a banquet, or do anything else, except run for Congress?

If you do not know how to equip your factory consult an expert in this line who has nothing to sell but services.

In buying machinery do not forget what the textile manufacturer told his friend, when he asked if he couldn't sell the obsolete machinery to some other mill, "Alas! the mills that used to buy our discarded machinery have all failed." The jewelers that are using obsolete machinery have not all failed yet, but watch them. The high price of labor is forcing them to increase their profits by modernizing their equipment, or

throw up their hands and quit, and some of them don't want to quit. Bear that in mind.

Not forgetting our title is "How to Make," not "How Not to Make" jewelry, we will divide the process up into departments, as is the modern way, treating each branch as a separate chapter, beginning with tool making, not overlooking the fact that many tools can be purchased from job shop toolmakers to a good advantage. Still, it is to the advantage of both the manufacturing jeweler and the job shop man for the manufacturer to have a tool-making department in his own factory.

CHAPTER II.

TOOL MAKING FOR PLATED JEWELRY.

The Engine Lathe as the First Requisite—The Use of the Milling Machine—Standardizing Tools—The Proper Files—How to Handle the Die Question Economically.

MAKING tools for jewelry consists of taking a piece of steel and cutting off all you don't want, This is very similar to the work of a machinist. In fact the best definition of a toolmaker I have ever heard is "advanced machinist" Consequently, if you are going to employ and pay for an advanced machinist, it is policy to provide him with advanced machinery to work with. To cut steel by obsolete methods is slow and expensive. The first machine to be considered in a tool room is the engine lathe. What the plow is to the farmer, or the cook stove to the cook, so is the lathe to the jewelry factory, or any metal-working industry.

Now the lathe to be an economical working machine must be up-to-date. In choosing the lathe perhaps it is not necessary to take the highest priced, but do not be governed by price alone. It is essential to have a lathe with a quick change feed, so that a roughing cut can be taken with a coarse feed, as feed beats speed in production; then change quickly to a finishing. feed. The machine tool builders designate lathes as manufacturing lathes and tool room lathes. A tool room lathe, besides the quick-changing feed, has a draw-in attachment for collets, a taper attachment, or at least built to take one later, and of course a compound rest, and must be of a size consistent with the class of work you intend to do.

The next machine is either a planer, shaper or milling machine. Each has advantages peculiar to itself, and in a full-sized and complete tool room, I should recommend all three. But I am assuming that this is a small shop, just starting; then I should say, a milling machine, as having the greatest scope of the three; also doing the work more economically on most of the jobs.

It is not always necessary to have a "full Universal" miller. In fact, a plain, or better still, a duplex miller, will handle almost anything to be made in a shop of this kind, but be sure the feed can be shifted quickly. Have it fitted with draw-in collets, perfectly interchangeable with the engine lathe. You must also have an accurate swivel vise graduated in degree, and some form of dividing head; and in addition to regular arbor a fly arbor, and a good supply of milling cutters. Unless you are located near a jobbing machine shop that will grind these cutters, you must have some kind of a cutter grinder, as milling cutters must be kept sharp. And get your mill of a size that will match up well with your lathe.

Then if you have a drill press such as is known as a sensitive drill, a power hack saw, a cutter miller, a small two-wheel emery stand, and some form of a surface grinder (a hand feed machine will do,) you can get along and produce good tools at a reasonable cost, although what is called a precision bench lathe is a utility rather than a luxury, and in some classes of work an absolute necessity. As soon as you employ more than one toolmaker, for your own interest add that to your equipment at once.

Now before starting to make tools consider what was said in a previous chapter about standards, and standardize your tools from the beginning. First provide the tool room with an accurate surface plate, about a nine-inch plate will do, then a good hand press, and have it tested to be sure that slide is dead true

with bed. Have it fitted with plunger holder having a hardened steel bushing for receiving shank, and an accurate and rigid die dish or cutter holder with correct angles. Five degrees is the best—a circular holder turned from mild steel being the most satisfactory. A correctly tapered wedge is the best method of holding the cutter plate.

Now any press tools made to fit these cutter and plunger holders, and tested up with the surface plate and square, are correct and standard, and any trouble in the press department can then be laid to other causes. I am tempted to enlarge upon this subject; I could preach a sermon on standardizing cutters and plungers, making the shank true and correct size, having the beveled sides of plates the correct angle, and flat on the bottom so that they will lay on the surface plate without rocking. I could write a book on the manufacturing troubles I have found, caused by ignoring this simple matter and the endless troubles I have corrected by going right back to this source; but I will try not to weary the reader.

If you are just starting don't allow these evils to creep in; if you are already established, and have trouble assembling your parts, or doing bench work, incurring an unreasonable expense caused by confusion and broken tools, difficulty in getting and keeping satisfactory help, and a general sluggish production, here is where the trouble can generally be found, if the right man looks for it.

Probably the greater part of the toolmaking in a small factory making plated jewelry is cutter making, although if you mean to compete and lead, you will be obliged to employ an all-round toolmaker, a man with ideas how to do things. A man that lacks enthusiasm and is not interested in the job never excels as a toolmaker.

Still, a cutter maker specialist can beat the all-round man making cutters, and to give him a fair chance to

make good, first get the right steel. Almost any of the American tool steel makers can furnish you with that if you know the requirements. The price has very little to do with picking out the right steel. You must take into consideration that you are to punch brass and not steel; consequently you do not need as tough a steel for steel manufacturing, or as lasting qualities as novelty makers, where a hundred thousand or a million pieces at one run of press is common. In jewelry work the great majority of cutters are never required to cut more than ten thousand pieces; consequently you can use a steel that is annealed very much softer than on the other lines mentioned. And there you are. The softer the steel the greater the speed of the cutter maker, and the greater the speed the less the cost.

Having in mind keeping down the cost, now is the time to mention files. One of the shrewdest manufacturers I have ever known used to say, "There is no money in dull files." Almost any manufacturer can make money for himself by taking dull, worn-out files away from his help and giving them to the junk man, so no one can waste time trying to use them. The man I referred to used to throw them in the pond. In selecting these files consider size, cut and shape. The best practice is to let the toolmaker select them himself. It is poor policy to force a man to use tools that are not in accordance with his ideas, and a man that never uses a file is no more fitted to buy them than a bricklayer is to select brushes for an artist.

Outside of cutter making I will not go into details except to say, get an ingenious man and keep him. What the jewelers call dies, more properly speaking, embossing dies, it is not good practice to attempt to make in a small factory. First, because where there is only one man as both designer and die cutter, he is apt to repeat himself, and also work to more or less disadvantage. Die making has become a business by

itself. If one firm of diemakers does not suit you, try another. You will then have the advantage of many artistic ideas. You can stop the expense at any time. The objection is sometimes raised that there is nothing exclusive about a die procured from a die shop. That is an erroneous idea. Think of what would become of a die company that made duplicates of their customer's dies to sell to competitors. It is not done. There are many good die making concerns that will furnish you with ideas and dies, and otherwise look out for your interest at a less cost than if you tried it in your own factory. Trust them for that, as they have every reason to keep you as a permanent customer.

CHAPTER III.

THE STAMPING AND PRESS WORK.

The Stock Used—Taking Care of the Rolls—Gauges and Micrometers—The Kinds of Presses to be Used—Automatic Power Presses Favored—The Round Tapered Die—The Single and Double Acting Presses—Accidents Easily Avoided.

WE will assume that in this shop the plated stock will be bought of plate manufacturers, as that has become a specialized business in itself. Stock plate is designated by both the quality and thickness of the gold; for instance, one-twentieth, twelve, means the weight of the alloyed gold is one-twentieth of the total weight, and the 12 indicates the karat, or 12-24 fine gold, the alloy to be of the right metal to give the desired color. It is by all means the better practice to buy stock of the plate manufacturers, as they make it in all grades, both in flat stock and wire. One-twentieth plate is considered very good quality. In fact rolled plate goods are made in plate as thin as 1-100 and as low karat as 8.

In buying stock it is better to buy the thickness that you intend to use, not trying to do the rolling in your own shop as a regular thing. Unless a man is in practice it is difficult to roll stock straight and even, and always maintain the good finish which is highly essential. You must not be obliged to polish off an excessive amount to get a finish. In equipping your factory, however, it is well to have one small rolling mill about 3x5, as an emergency tool, as it often happens that some order calls for a thickness of stock not on hand, but you may have on hand some left-over of a

greater thickness, which, by rolling down, you can use with less waste.

These rolls must be kept clean and smooth and free from all grit or anything that will scratch either the rolls or stock. Put nothing but clean stock through them. Remember this through all processes; keep stock clean and avoid all grit or scratchy substances. It is more economical to avoid scratches and scars than to cover them up later, and a good finish is a long point in selling the goods.

In rolling stock always keep the same edge of stock next to the same edge of rolls. In turning it over, turn endways, never sideways. If you use the right system of gauging or measuring stock you can tell just how much a piece of stock will lengthen out by rolling a given thickness.

We will now touch on how to gauge the thickness of stock or the size of wire. Some shops use what is known as the dial gauge, which is a fairly good system, except that dial gauges have no definite standard. Then there is what is sometimes called a stock gauge, and too many manufacturers still use the American standard wire gauge. I consider all of these gauges a mistake; the only excuse I have heard for them is that "we have always got along with them." But really their numbers do not mean anything. How does No. 20 compare with No. 30? It is not as 20 is to 30, because the gauge is not made that way; 30 is thinner than 20.

Now the only really satisfactory way to gauge or measure stock or wire is by micrometer, for the following reasons: It is standard in all kinds of manufacturing in the United States and Great Britain. The micrometer divides an inch (English measurement) into one thousand parts. There is no question about the standard of the inch, that is 1-36 of the standard yard, legalized by the United States Government, and it is the same standard authorized by Great Britain.

Now if you use this system (which all up-to-date manufacturers do use) and you have two pieces of stock of equal lengths and widths, one .020 thick and the other .030 thick, the .020 is two-thirds as thick as the .030 and will weigh two-thirds as much, and if you wish to use stock half that thickness, .015 is one-half of .030. It is as easy a system to figure as counting your money. You can buy stock, wire, steel arbors, drills, saws, milling cutters and almost anything else by it. Don't allow any other kind of a gauge in your shop. Two or three different gauges in a shop cause as much trouble and confusion as if you kept your books part in U. S. dollars and cents and part in German marks, and a few accounts in English shillings. It surely is "some mess." Simple and practical standards mean production and production means profit.

For stamping or drop press work there are two kinds of stamps in general use, the foot stamp with a power countershaft overhead to help lift the hammer, and the more modern "full automatic." There is very little to be said in favor of the foot stamp. Probably the only job it can be used for to better advantage than the automatic is in getting up forces. Each embossing die requires a "force" or male die. These should be made in your own shop and it is customary in most of the shops to have the stamper get up his own forces, but as this is a job that is more like toolmaking, inasmuch as they are generally made of steel, I would advise that they be made by the toolmaker, and the dies and forces delivered complete to the stamp and press man. As these two departments, Stamp and Press, depend so much upon each other it is the best practice to have them both under one competent man.

In making forces a coarse-grained low carbon steel is better than the more expensive grades, as it is required to stand hammering, and the fine-grained high carbon steel is too brittle.

If you decide to buy both a foot and an automatic stamp, about a hundred-pound hammer is right for either, but in the event of having only one, get the automatic every time. Some will tell you differently, but to simmer down all the objections to the automatic, it amounts to prejudice against up-to-date methods. In buying or choosing these stamps have the face of the hammers dove-tailed to receive the "jack die" or force holder. Have them both alike, as the holders will be interchangeable. These dove-tailed hammers are not quite so common as the round tapered shanks, but much more practical. The old-style round shank jack had an advantage with the old-style square forged die, but we are not recommending the use of any of that kind of dies. The only excuse I can find for their use is that the diemakers claim that they are more convenient for them to hold while cutting.

What we are recommending is the round tapered die, and do not have these dies too thick. Any die of a two-inch diameter or less should never be over one and one-quarter inch high. Have them all a standard size and taper. If you need three sizes of dies for your work make them one and one half inch, two inch and three inch round stock with correctly placed dowel pinholes to fit the holder. There is a patented circular holder with a screw cap for holding down the die, that has been on the market for many years. It is used by all up-to-date manufacturers of small plated jewelry. You can't beat it.

With this outfit your dies will be easy to set, interchangeable from one stamp to another, and give you no trouble. This is another point for the standards; never forget that. When you are persuaded to allow one die of a style or size not your standard, you are planting weeds in your garden to be uprooted at your expense at some future time. The man having charge of this work should inspect every new die before us-

ing, and reject all that are not according to standard. A world-famous manufacturer said "the time to tighten a loose bolt is just as soon as it needs tightening." This is true with all manufacturing troubles. The cheapest time to fix them is just as soon as they are encountered, and the sooner discovered the less the expense. Have no misfits or makeshifts in the way of rapid production.

Now for our press work. There is no job on a hand or foot press that cannot be done quicker, cheaper and better on a power press. As far as hand presses are concerned, they are fairly useful for flattening small pieces if you are working in small quantities, and let me say right here that a press used for flattening is almost never in good enough condition for anything else.

In a small model shop I should recommend for the press department two hand presses, one fitted with a good pair of flattening dies and kept exclusively for that purpose, and the other as a convenient tool for the man in charge to test tools from the tool room; try them out for a few pieces or do an occasional emergency job. Do not consider it as a paying producer. The foot press has one other advantage. It is low in price, and for many light jobs of bending and forming can be operated as fast as a power press. In many shops, particularly in button making, it is customary to have a foot press fitted up with some tool for a light special operation, and not take that tool out as long as that particular article runs. The price of the press can be saved in the time taken in shifting tools in press a few times each day, besides always being ready. Don't be afraid to buy foot presses.

But the bulk of your work must be done with power presses. Do not be deluded into putting a large amount of money into a complicated double action press. That, you will be told, has scope enough to do any and all kinds of work, but this is an impractical idea. The double ac-

tion press is all right in its place, doing double action work, that is, cutting and drawing, but for the all-round utility outfit of presses for this shop you need about three single action presses, one very small press for light, quick work, one a little larger, say a hundred-pound balance wheel press, and about a three-hundred-pound balance wheel press. In selecting these pay particular attention to the convenience of operating; presses of the overhang type are preferable to the arch press, as they are more convenient and stiff enough for jewelry work. It is also advisable to get at least one if not both of the two larger sizes, with height enough in throat to take in sub or pillar press tools, as most of the damage done to press tools comes from setting up. The sub press system does away with all of that. Any unskilled worker can set a sub press tool in the press, and I certainly advise having all complicated tools made on this system.

There is a sort of old-fashioned idea that tools cost more to make for a power press than for a hand press. That is not true. Any tool that is made for a hand press can be put right in the power press without alteration if the standards that I recommend are lived up to. Then the wear and damage to tools are less on the power than on hand or foot press. The labor and skill required are no different.

Then there is the fear of accident to the operator. This is negligible if a few simple commonsense rules are observed and strictly lived up to. First, never try to set tool or adjust with balance wheel of press running. If press is not provided with countershaft, but belted direct to wheel, throw off the belt before setting. Then after the tool is set turn the wheel over once by hand to see if all is right before applying power. Never, if it can be avoided, put your fingers between the die and punch. It is sometimes said this rule cannot be followed on hand feed work. My answer to this is that the best all-round pressman I ever saw, both for speed and efficiency, always followed this rule. He had an assortment of

tweezers for one hand and different sizes and shapes of sticks that he called his "chop sticks" in the other hand, and I never saw the man or boy in competition with him that he couldn't beat in feeding a press and never get his fingers where there was a possibility of getting hurt.

Here is a chance to borrow a leaf from his book. He personally inspected every new cutter or tool given him to use, and if not according to standard Mr. Toolmaker heard from it before it was used once. The same with every piece of stock. He took nobody's word for it. It was measured by micrometer by himself, and if not according to specifications he put it up to the foreman before a particle of it was used. Then if any off-size tools or poor stock was used it was by positive orders from higher authority and no come-back. It was the old rule "first be sure you are right then go ahead," and go fast. Explain this system to the man in charge of your stamp and press work and if he lives up to it you will find it the greatest labor saver you ever struck.

With a stamp and press outfit such as I have described, of course, including a wrench for each press and to fit that press, suitable oil cans, a good one-inch micrometer, and a book or card system to enter orders in, a pressman should give you component parts of jewelry rapidly and good. I will just mention the fact that it is better to give all orders for this, as well as other work to be done, in writing, to avoid mistakes and misunderstandings, but be careful not to make this written order system too cumbersome. Make it plain and direct and have it signed, so that the man giving orders is responsible for his mistakes.

In the following chapters I shall take up pattern making, assembling or bench work.

CHAPTER IV.

THE BENCH LATHE.

The Milling, Drilling, and Grinding Department—The Use of the Bench Lathe and Its Equipment—The Drill Press—The Emery Wheels and Their Uses.

AFTER the component parts of jewelry have been stamped on the drop hammers, cut out and formed, swaged on presses, there is quite frequently other things to do to it before assembling or soldering the parts together. The old-fashioned way of doing this was to leave it to the individual idea of the bench hand or jeweler, as he was then called, who made use of the simplest form of a bench lathe, which he used for drilling, what he called "burring," which, strictly speaking, is milling, by the use of a revolving cutter. And quite frequently he attached an emery wheel to the same lathe and used to grind off certain portions, as that proved to be a faster process than hand filing.

Now these methods are obsolete; they do not admit of standardizing either the labor or the results. It requires more or less skill and ingenuity from each operator, and is in no way conducive to quantity production, and we are still remembering that the profits are in standardizing and specializing.

So we will add another department, which has been put in practice by progressive manufacturers. This we will call Milling, Drilling and Grinding department. The same should be in charge of a competent man, one having some knowledge of machinery, plenty of ingenuity, and a good knowledge of how to cut gold, silver, brass and any of the basic metals used in mak-

ing jewelry. And bear in mind that these different metals do not all require the same speeds, feeds, shape of milling cutter teeth, or the same grade of emery wheels. But as a general principle they all require a faster speed than steel or iron.

In equipping this department it is well to have one bench lathe, with a full equipment of tools and fixtures for same, including a good hand feed slide rest, an arbor to hold burrs, saws, etc., and be sure this is a standard size. It is better to attach this to lathe spindle by the draw-in collet system (as it is on all lathe and milling jobs). Then a good accurate running drill chuck small enough so that it could not be used for work too heavy for the lathe. Now this machine is to be used as an emergency or experimental tool by the man in charge, as the lathe is a machine having the greatest scope of any metal working machine. Do not consider it as an economical producer of goods in quantity.

The proper type of lathe to buy for this purpose is of a well-known pattern with slide rests built as a part of the regular equipment, and not as a makeshift afterthought. These lathes are not high in price, are of a standard size, and can be duplicated at any time.

Now for general rapid quantity production on such operations as sawing or burring, use special millers, one for each job; do not be afraid to have too many of them. They are simple little inexpensive machines to be placed on a bench. They cost much less than a lathe, are quickly operated and are laborsavers if used intelligently. The same rule holds good on this as that spoken of on foot press work—have a machine for each set of tools; fit the tools to that machine and leave them there as long as that particular line runs.

Now I realize that this system is not in general use, still it is, in a few very much up-to-date factories, and I notice they all happen to be money-making plants. The first time this system was called to my

attention was more than thirty years ago when the manufacturer had to design and build these little machines himself, and even did the labor with his own hands. He retired with an independent fortune years ago, after proving that there was money in specializing and standardizing.

If you are in doubt or puzzled about how to install this system consult an experienced production engineer, who specializes on this line. He can always be found if you read the advertisements, and a man that does not read the advertisements pertaining to his business will not succeed anyway.

With these little machines you must have a good assortment of saws and milling cutters and keep them sharp. Dull tools will give as poor results as the man gets that shaves with a dull razor. Keep all your tools in a state of "high efficiency" and your help will keep so. When your tools are not doing good, fast work your help soon gets in the same condition.

Then you must have one or more drill presses, and while you are about it, get good ones. A good one for the purpose means a light, but accurate fast running machine. To use a small drill, as you have to on anything pertaining to jewelry, you must have high speed, and it must be quickly operated and run true, unless you want to favor the drill manufacturer by breaking a lot of drills so you can buy more. These drill presses will probably be used more or less in stone setting and in drilling shell and pearl, consequently they should be located where the light is the best.

Then there must be some emery wheel stands. I would advise two of these machines carrying ten-inch wheels. They are not high in price, and if you are making plated work, either the stock or brass electroplate, you will have occasion to grind on emery surfaces from both the stock that has gold on it and the stock that is to be plated later. All the dust and grindings from the first must be saved for refining to

recover the gold. It is a waste of money to pay for refining the pieces on which there is no gold, so don't mix the two.

The speed to run these machines is a very easy matter to determine. Have the spindle speed fast enough to give the periphery or outside surface of the emery wheel a travel of 5000 feet per minute. Less speed than that will not give goods results; over 6000 is dangerous. Do not confuse this 5000 feet with spindle speed. A ten-inch wheel to have a periphery speed of 5000 feet should revolve 1908 times per minute. In buying emery wheels, note that they are graded in two ways: the grit and the bond. The grit numbers refer to the size of the particles of emery, and the bond is the material that binds or sticks them together. It quite often happens that a wheel will be pronounced too coarse, and a finer one bought, only to find that it works no better, and perhaps glazes over sooner. Now the trouble in this case was not with the coarseness of the grit, but with the bond. This is why one man should have the care of these wheels; also a chance to talk with the emery wheel salesman. He will soon learn just what wheel will give the best and quickest results, and it is results fast and good that we are after.

There is an old but true motto that it is good to live up to in manufacturing, "First be sure you are right, then go ahead." And don't forget to go fast. Always remember that this rule is meant for the manufacturer as well as for the help. It is unreasonable to expect the employees to live up to it if the employer persists in providing tools and materials that are not right, and here is where the stagnation begins in most jewelry factories.

CHAPTER V.

PATTERN-MAKING AND BENCH WORK.

How One can Secure Ideas from the Female Help—Instructions about Soldering and Brazing—Foremen should have been Workmen—The Job Gang System.

I DISTINGUISH pattern making in a plated jewelry shop from designing because there is very little call for strictly original designs in plated work for the pattern maker to furnish. The artistic designs that he will have occasion to use will be on the pieces that come from die-cutting companies previously mentioned. What the pattern maker will really be required to do is to make up different combinations of these component parts in an attractive manner, not forgetting that these combinations must be put together with the minimum of labor and maximum show. In fact, I know of no better definition of a plated pattern maker than "an advanced jeweler." He or she must be a neat worker, tasty and practical, able to reproduce his own patterns cheaply in quantity production, and in addition to parts from the stamp and press departments make use of the ideas and supplies furnished by what is known as jewelers' findings companies.

Adaptability to conditions as they are, and keeping up to the freaks of fashion, rather than what would be considered high art, is the pattern maker's trump card. The aim of the very high-class makers of gold jewelry is exclusive designs that cannot be imitated in the low-priced goods. The pattern maker must aim to get that same effect at a small fraction of the cost, just as the department store milliners produce very attractive imitations of the highest priced Paris creations.

I will now consider the "shop girl" as a pattern maker. This is rather an unsual practice in jewelry factories; still it is done. Many old-style jewelers consider the girls as helpers, not as workmen, but this is an erroneous idea. There is nothing about bench work in the jewelry factory that a girl cannot learn to do, providing she has any natural mechanical ability,—enough of it so she could learn to trim hats, run a sewing machine, or successfully work at any of the trades that are considered women's trades. After learning to do the various things required of the jeweler at the bench it is only a step more to make the pattern, and a girl's taste points more readily to good sellers than a man's. Many times I have seen a girl put some simple combinations of parts together for her own wear that beat any of the patterns that the company had paid good money for and were trying to sell. I have also seen men pattern makers who really got all their ideas from the low-paid girl helper. There are a few shops that employ girl pattern makers. Take a tip and give the girls a chance, and prepare to be surprised at results.

There are a few fundamental facts concerning bench work that should be understood by both the workman and the boss. First, consider the tools. In the matter of tweezers, pliers, cutting pliers and shears, the best are none too good. The clumsy German-made tools, of the kind that the market was flooded with a few years ago, and which never were an economical proposition, were fit to be sold only to a shop which employed a buyer who had never been a workman. One of the reasons that the little shops just starting can and do compete with the big ones is owing to the tendency of the old rich companies to employ office men and clerks as buyers and foremen. This practice is of great benefit to the small competitors as well as to the dealers in supplies and tools.

There is some filing to do on this kind of work. The right file to use is a sharp one, with the right cut to clear well in soft metal; try different kinds until you

get one that has these qualities, then remember in filing to do it fast. Take a stroke the full length of the file, quick and straight, and you will find it has left a smooth surface. There is a knack about this that only comes with practice, but it is not hard to learn.

Perhaps the most important part of bench work is soldering, or, scientifically, brazing. To solder or braze is to join two or more pieces of metal together with a metal that will fuse or melt at a lower heat than the parts to be joined. To do this successfully first see that parts are clean. Remove all oil or grease by washing in an alkali solution, such as potash or sal soda dissolved in water and used hot; then remove scale, tarnish or other stains with hot pickle. The pickle in common use is composed of three parts water and one part sulphuric acid, or what is commonly called oil of vitriol, and remember before being diluted this acid must be handled with extreme care. One drop of clear vitriol will destroy an eye or burn a hole in the flesh almost instantaneously that will leave a lasting scar. After you put work in pickle rinse in clear water and dry.

The right kind of solder to use depends entirely on the job to be handled, but on most plated work the best results are obtained with silver solder. This can be had in all proportions of silver, but anything less than 50 per cent silver does not deserve to be called silver solder. My belief is that very little if anything is to be gained by using too low a grade of solder. You want a solder that will flow quickly and smoothly. The solder manufacturers will sell you this suitable for any peculiar condition that you meet. If you need definite instructions in this matter time and expense are to be saved by consulting a specialist on rapid production.

Before applying the solder, or charging, as it is called, you must use a flux, which is commonly some compound of borax. The reason for a flux is that solder will not fuse to a tarnished or oxidized surface, and by having

these surfaces covered with borax, when the heat is applied, the borax instantaneously melts and protects the surface until the solder melts, and then rises or floats on top of the molten solder. This is the reason the solder will flow, as the jeweler says, where the borax is.

In doing a good neat job of soldering remember to heat quickly. Of course, you will use a power blowpipe. Be sure to have a good flow of gas and a strong blast of air, then regulate your flame to heat quickly but in the right spot. Do not be afraid of too quick a blaze; the borax follows the heat, the solder follows the borax, and fast work of this kind is good work.

The best way from all points of view to handle this work is to have it under the direct supervision of a competent foreman, and I have no reason to believe that a foreman ever was competent unless he had been a workman. There is a system quite common among some of the larger manufacturers of having this kind of work done by setting a price on it as piece or job work, giving it to a man that is called a gang boss. He in turn has the other workers in his gang charged to him. This is an excellent plan for the gang boss. I have known very indifferent if not inferior workmen to make (not earn) large sums of money this way, and the manufacturer fondly believed he was getting profitable results. But from a disinterested point of view, based upon actual experience, this system dissolves itself into an admission of incompetence in the foreman and is so considered by the workman. It simply means that the gang boss adopts workmanlike methods of doing things that he makes a point of not using when he is on day or hour work, and the man in charge thinks he is speeding up, when in reality it is because the man in authority is not workman enough to see through the camouflage.

There was an incident which came under my observation of a gang boss taking a job at a price quite a bit under what the elaborate cost system showed to be the cost, and the first move he made was to get into the shop one

morning as soon as the doors were open, bringing with him a few piper's tools and fittings, and make a slight change in the gas piping, thereby giving his gang a good instead of poor supply of gas to solder with, resulting in increasing his income more than 200 per cent and winning a name for himself with his employer as being a wonderful workman. If this company had employed a competent mechanical superintendent could he have gotten away with it?

This is only one of the many tricks I have seen played by the "job gang" boss. This article was not started as a joke book, but I would advise the reader not to encourage such expensive jokes. Better call in a consulting engineer once in a while to help you find the joker. It will pay.

If your shop is fitted with efficient tools, and the workmen provided with labor-saving devices, proper conveniences and material, and encouraged to use them, there will be very little for the job boss. When a man makes two or three times as much by the job as his rate calls for by the hour there is always a joker there.

CHAPTER VI.

USE OF AUTOMATIC MACHINERY.

Machines for Making and Uniting Chain Links and Soldering the Same—Did the "German Machine" Originate in Providence?—The Machine a Humanized Power Press, Fitted With Ingenious Cams and Springs.

THE use of automatic machinery depends upon circumstances. If you decide to make an article for which there is a demand, produce in quantities,—and here is where the use of automatic machinery comes in. Automatic machines are designed and contructed to perform two or more operations in shaping or forming a part, with ony one handling by the operator. They sometimes seem very complicated and puzzling to one unaccustomed to them, but by watching what they are really doing you will observe that they are almost following the motions made by the human hands in producing the same results by hand labor.

Probably the automatic that is best known and widest used at present is the chain machine. If you contemplate making chain do it by chain machines. There are two types of chain machines in general use: what is known as the American, and what is usually called the German machine, or Ham & Durr type, which seems to have the call among manufacturers.

Perhaps it would not be out of place to give a brief history of these machines, as we do not care to give Germany too much credit for something she is not entitled to. These machines were imported or brought into this country from Germany a few years ago, about 1911 or 1912, under the representation that they were a German invention. The writer was at that time employed by one of the first concerns to import and operate these ma-

chines, being detailed to inspect and operate these German sample machines; consequently he was in a position to find out a lot about them.

I certainly have every reason to think that it was invented in Providence, Rhode Island, about 1893. After the inventor failed to get local manufacturers interested, on the ground that they already had machines, he took his model across to Germany, and sold it to the same company which sent them over here about fifteen years later. I think the original inventor can still be found in Providence.

There was, and I think is now, a belief that amounted almost to a superstition that it required a German to successfully operate these machines. Far be that from right. It really makes no difference whether the operator is German or African; neither does it require a good all-round toolmaker. Almost anybody with a fair amount of mechanical intelligence can learn the whole thing in a few weeks. I should be very much surprised if a girl that could successfully operate a power sewing machine in a factory could not learn to be a chain machine operator in three months.

Now for the machine itself. It is built on the general lines of a power press. The different members that perform the various duties, such as feeding the wire along to the proper length to form a link, passing this wire through the link previously formed, cutting it off and forming it into the shape of a link in a chain, are located on the bed of the machine, and the movements controlled by a series of cams and return movements by springs. These cams are all placed on one horizontal shaft that receives the power, and the trick comes in so timing the cams or placing them in proper positions on this shaft that they will operate the parts at the proper time.

It can readily be seen that it would be useless to try to form a link before the wire was cut off, and equally impossible to attempt to close this link before shaping it intc

a U shape. Consequently the cams must be set, or "timed" as it is called, in the order that the operations call for, the last being to place the link just made in position to receive the next link. Simple, isn't it? but here is where the work of the operator or adjuster comes in. These machines can be adjusted or set up to make several sizes or shapes of chain, but to compete with the market it is best to have as many machines as you make sizes or kinds of chain. For the same reason given in a previous chapter concerning power press work for quantity production, it does not pay to waste time changing or setting up tools when these machines should be producing goods to sell.

It would not pay a small manufacturer to try to develop and build these machines, but by looking over the advertisements in *The Manufacturing Jeweler* you can usually find where to procure them, also where to get engineering advice as to what machine to install and how to operate them. Taken up in this manner it is not an unknown quantity; you can go ahead and get equipped and in operation for a predetermined investment.

Next to machines for making chain come machines for soldering the links. These are again imitation of hand work; the wire for links must be what is known as solder filled, and after chain is made must be thoroughly cleaned and "fluxed," usually with a borax solution, and this borax removed from surface of links without disturbing what is in the unsoldered joints. This surface is then coated over with a substance that will assist rather than prevent oxidation, and passed at the right speed under a gas flame. These machines are provided with means of regulating both the flow of gas and air, as well as the speed that chain is fed under the flame.

As before stated, you can easily obtain detailed instructions about machine chain soldering, or any other manufacturing problem, and if you are not entirely familiar with a process it is best to consult a production engineer in that line of business.

CHAPTER VII.

FITTING UP A POLISHING ROOM.

Machinery that is Needed—The Use of Polishing Tubs—The Electroplating or Coloring Art—The Use of the Dynamo.

FIT up your polishing department with both polishing lathes and tubs. A polishing bench for a shop of the size considered in these articles should have at least four lathes, and in buying polishing lathes remember that the lathe that will run at the highest rate of speed is the best, as the faster the buff or brush revolves the quicker it cuts. Consequently you should insist on a machine that will run fast without trouble.

Speed of polishing heads varies greatly. Usually it is from 3500 to 4000 R.P.M. This, in the writer's opinion, is not fast enough, but is about the limit of most of the machines on the market. Six thousand or even 7000 R.P.M. would be none too fast, and I should certainly look the machine dealers over very carefully, to find some maker that could furnish lathes to run that speed.

Then I should equip with tubs of the open and closed type, as tubbing is a very satisfactory method of finishing goods in quantities if managed intelligently, but it requires good judgment as well as experience. Briefly, it consists of allowing the pieces to be polished to rub against each other, usually in a soap solution, and it must be borne in mind that any sharp corners will not only wear away first, but pit or spot the smooth surfaces of other pieces.

This is a subject on which no general details can be given, except remember that polishing done by this

method is a surprise to many manufacturers, and I would advise consulting with some one experienced in quantity production to start you right. If you read the advertisements in *The Manufacturing Jeweler* you will observe that manufacturers of this kind of machinery make them for all conditions that you will encounter.

The art or trade of coloring or electroplating consists of depositing gold or silver on base metal by an electric current, and to do this successfully requires more or less knowledge of both electricity and chemistry. The apparatus needed is a dynamo for generating direct current electricity, suitable tanks or earthen crocks for containing solutions, and means for heating same, as some of these solutions must be used warm, and some cleaning solutions hot.

To get at the matter theoretically you must first clean the article to be plated. This does not mean simply to wash it, but it must be absolutely "chemically clean"; that is, not only free from all oil, grease or other substances, but free from corrosion, tarnish or oxidization or any of the conditions that base metals are subject to. It is impractical to give complete directions and formulas for electroplating, as there are so many different conditions to be considered, but the cleaning just mentioned applies to them all.

The dynamo must be of sufficient size to generate enough current for all the work you can hang in the solution at one time. In other words, the dynamo and solution holders must be of a size consistent with the amount of work to be handled. The wiring must be of suitable size to carry all the work the tanks will hold. It is quite customary to use a dynamo of about 15 voltage, as that is the highest that is used, and when a lower voltage is required, to reduce by the use of resistance coils. This is a method that requires quite a lot of good judgment and fine adjustment, and if your work is in large quantities it is better to standardize. That is, remember that like condi-

tions always give like results, and the lower the electric voltage the finer the deposit, but also the slower.

After determining what kind of a deposit you want, regulate the dynamo speed to give the voltage actually required, doing away with resistance coils as far as possible, as a resistance coil is nothing but a brake, and all brakes are more or less uncertain.

It should be the aim of the colorer to waste as little current as possible, and that can be done only by generating just what you use. In case your business does not warrant the services of a high-class electroplater, it is best to have your plating outfit installed by some reliable company who can fit you out according to the kind of work you intend to do.

CHAPTER VIII.

CHAIN MESH AND SCREW MACHINES.

The Chain Mesh Machines next in Importance to Chain Machines — Mesh Machines an Adaptation of Chain and Knitting Machine Mechanism — Button Making Machines — The Screw Machine.

NEXT to the chain machines in general use come the machines for making chain mesh. The method of making the product is not unlike chain making. The machines in use on this work, both in this country and Europe, are of two types: first the machine that has the general appearance and characteristics of a textile knitting machine, making a soldering chain, that is, by the use of solder-filled wire, tubular form, the tube vertical and feed up. The weight of mesh already made is counter-balanced by weights hung on a cord, passing over a pulley attached to the ceiling directly over the center of the machine, and connected by a swivel to mesh that is slowly revolving and rising as the tube grows in length. When the tube gets of sufficient length to become heavy it is cut off just above the machine and then split lengthwise, causing a waste of approximately one-half of one per cent. The forming of the ring itself is identical with that of a chain link, except that the staple first formed passes through two links already made instead of one, as in the case of chain.

This machine is a direct adaptation of the well known mechanisms of the chain and knitting machines. The other type of machine, that is by many experts, especially in Europe, considered superior, forms the link much the same, but no doubt feeds the wire in a more positive and

better way, and makes the mesh as a flat fabric instead of tubular, and as this can be made in any convenient width it does away with the waste in splitting that the tubular form is subject to, and can also be cut to a better advantage. The original inventor of this machine probably was the first to form and place the link in position through the previously formed rings, but from lack of financial backing was delayed in perfecting the mechanism for feeding flat mesh into position to receive the next link; consequently the patents are of a slightly later date, but no doubt have more original features and hold more promise for future developments, being available for manufacturers wishing to take advantage of the world-wide demand for this product.

The process of soldering mesh is of the same principle as soldering chain, that is, by the use of solder filled wire to make the mesh, fluxing and heating much the same as in chain soldering. Up to the present time soldering mesh in a continuous strip or by a complete or semi-automatic process has not been accomplished. This is a good thing for inventors to consider.

Buttons of various kinds are also produced by the aid of automatic machines. The collar button is almost always made that way, generally on what is known as an eyelet machine. An eyelet machine is in reality a press, but with a number of plungers, each plunger or vertical slide performing one operation, and in place of dropping the part into a receptacle beneath the press, it is taken from the tool by a pair of ingenious steel fingers and placed in position to receive the next plunger, and so on until all the various operations are performed, as blanking, cupping, drawing, reducing the size of neck or stem, trimming surplus stock from the edge, and forming a rolled edge around the base, and finally dropping a completely formed collar button. Then there is another process that is about the same as the first, up to the point of reducing the post or neck, which is done by a spinning process;

that is, the cup or cartridge is rapidly revolved between rolls that slowly close together until the neck of the button is reduced to the desired size.

In making link buttons or any button, such as metal dress buttons or military buttons that have a wire eye on the neck, there are some very ingenious presses in use that cut and draw the cup, punch holes in the back, and at the same time and on the same machine form an eye of wire and rivet it into the button back without any handling by the operator. These machines or presses are so highly developed and produce so rapidly that button making by hand, or any of the slow methods, has become a thing of the past.

There is still another automatic machine process that is used more or less in making component parts of jewelry, and that is what is known as the screw machine. A screw machine is practically an automatic lathe on which the article to be made is cut from the solid rod of metal in place of being swaged or formed as by a press. The head or lathe spindle is hollow, and is revolved at a suitable speed, while the metal rod is automatically fed through the same, and at the same time cutters engage in cutting off the surplus material. Still another cutter advances in position and parts or cuts off the piece already shaped, and the cutters all fall back to the original position, while the stock is automatically pushed forward the right distance to turn the next article, and so on continuously. This is a method used in making the balls with stem used as clasps for bag and purse tops, also in turning ornamental hangers for mesh bags and other articles, and sometimes for turning chain bars or brass swivel heads, etc.

In closing these chapters, let me again caution the prospective manufacturer not to be afraid of what the ones ahead of him are doing. There is always room for improvement over the other fellow's methods, and the possibilities of specializing and standardizing, and the development of automatic machinery, have not been exhausted;

rather, in the jewelry business, it has only been scratched a little, and there are better prospects along these lines now than ever before.

When the argument is put forth that there is not room for more manufacturers on any special line, there is always the question of which one will be crowded out, and in wanting to know more about where to find special or automatic machines consult *The Manufacturing Jeweler,* or some of their advertisers. It is all between the covers, if you care to look.

INDEX.